The Seventh-Century Roman Kastra of Kalymnos and Telendos

Research Thesis

Presented in partial fulfillment of the requirements for graduation *with research distinction* in the undergraduate colleges of The Ohio State University

by

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For Madeline, who teaches me to create every time I forget how.

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Introduction

This thesis will investigate the fortifications on the Greek island of Kalymnos in the eastern Aegean (fig. 1) using Geographic Information Systems (GIS). While the thesis will consider remains from the Hellenistic to the Early Modern period, the focus of the study will be the Roman fortifications constructed in the 7th century, with secondary interest in the single fortification built in the 11th century. Photography and in-person recording was originally planned as a major aid to the use of GIS, but due to COVID travel restrictions this study relies much more heavily on GIS and satellite photography to make determinations about landscape.

The aim of this thesis is to determine the details of the fortification scheme of medieval Roman Kalymnos, including what threats informed it, what priorities it had, and how it might have worked in practice. With a focus on the fortifications of Agios Konstantinos, Galatiani, Kastelli, and secondarily Chora Kastro, GIS modelling will be used to determine medieval Roman-era fields of fire, approaches from landing sites, siting priorities, and other factors influencing these defensive structures and their use through time. This approach stresses the role of fortifications as force multipliers rather than mere refuges, and their fields of fire, sturdiness, and other considerations will be key in determining what forces were arrayed against them, and what forces were defending them as well. Surface collections, architecture, landscape, and contemporary works will also prove invaluable in this examination. In addition to fortifications, this study will make note of population centers, demographic trends, and land use across the island to inform analyses on the placement of defensive works. This study will have implications on the extension and maintenance of imperial hegemony through the self-preservation impulses of its subjects, the responses of insular communities under threat, the ways in which

communities can survive cyclical violence, and the tactical details of an unarmed populace's response to armed incursions.

The level of Imperial involvement will speak to the resources available to Kalymnians during this time, and with this in mind, analysis of the cost of construction, travel to and from, and supplying material to these fortifications will indicate both the severity of the threat to Kalymnos specifically, and provide insight into the daily concerns and priorities of common islanders living in unsafe waters.

Following the introduction, I present a review of the literature and historical background relevant to the present study, followed by chapters on theory, methods, results, a discussion and analysis of results and research questions, and finally a conclusion in which I summarize the findings and make firm determinations where possible.

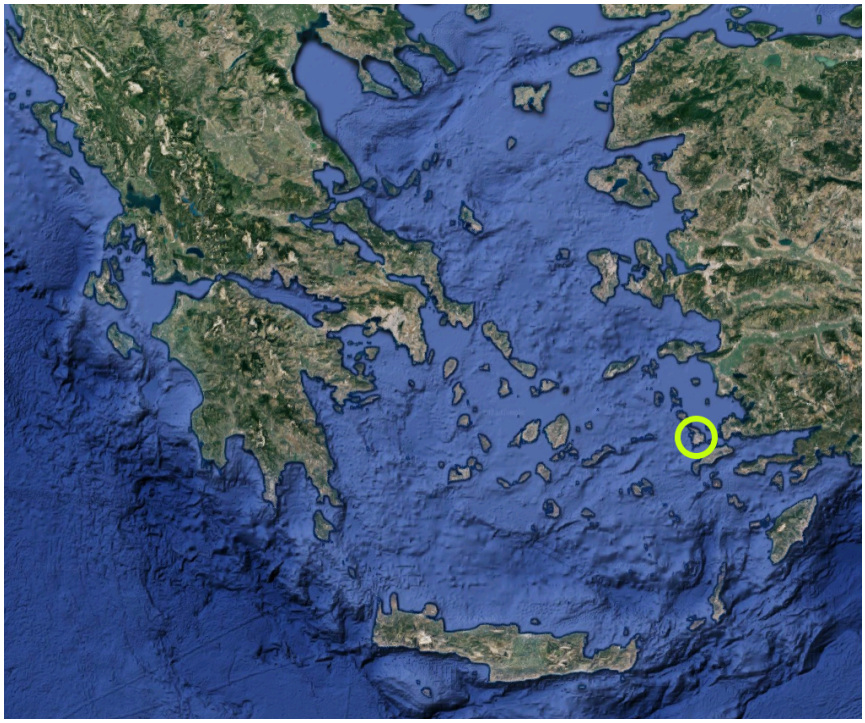


Fig. 1. Map of Greece and the Aegean, with Kalymnos circled in yellow. Map of Greece from: "Greece" Map, *Google Maps.*

Research Questions

The present study addresses the following questions:

1. What was the fortification scheme of Kalymnos during the late Roman period, from the seventh century to the end of Roman rule in the early 14th century?
2. What were the circumstances surrounding and prompting the construction of the island's Roman kastra?
3. What was involved in the process of fortifying the island, in terms of funding, labor, material sourcing, siting, etc?
4. What were the tactical and strategic characteristics of the kastra?
5. How did the Kalymnian kastra reflect the island's position in the Roman Empire?
6. What does GIS contribute to the understanding of these central issues?

Chapter 1: Background

Few nations in history have experienced a reversal of fortunes as sharp as that suffered by the seventh-century Roman Empire.[1] Much has been written about the consequences of this collapse, but little focus has been given to what would become one of the key frontiers of the ensuing war[s]: the Aegean Islands. The marks of conflict are evident in the histories as well as upon the landscape itself, as wars and raids transformed island societies. The island of Kalymnos is no exception, and its potential to inform an understanding of the cost of Roman-Arab warfare in the periphery has barely been tapped. The following chapter will examine the Roman fortifications of Kalymnos, evaluating hypotheses about the process of their construction, their purpose, and how they link into fortification schemes on larger scales, at the island and regional levels. In addition, this chapter seeks to elucidate the dynamics of fortifications as components of the island, and of the fortified island as a component of the Empire.

Through examination of textual sources, several key factors of the historical context around Kalymnos may be determined. Specifically, this chapter serves to determine the chronology of the island's four Roman fortifications, the nature of the threats they were built to face, and how and why they were built. In order to address these questions, this chapter will first describe the sites in question and consider the state of primary sources. I later examine the motivations and necessities behind the construction of the fortifications (kastra) through a look at contemporary threats, and argue for interpretations of the Kalymnian kastra as fortified permanent settlements rather than refuges. Informed by this foundation, as well as an evaluation of the nature of defensive systems in peripheral regions of the Roman Empire, before and during the adoption of the theme system. The kastra of Kalymnos were constructed contemporaneously with the development of the theme system, and, after several decades, eventually became part of

[1] Due to the Empire's uninterrupted possession of Kalymnos, 'Roman' is the appropriate term.

it in some capacity. This naturally creates questions as to the level of authority involved in their construction, and what degree of local autonomy was exercised in the process of fortifying the island, both questions which this chapter examines in detail.

Nisos Kalymnos

Fig 2. The island of Kalymnos, with major habitation zones noted. The southern valley is purple, the Vathy Valley/northern valley is light green, the western coast is brown, and Telendos' hospitable region (which does not include Agios Konstantinos) is in dark green. Map of Kalymnos, Greece from: "Kalymnos, Greece" Map, *Google Maps.*

The Greek island of Kalymnos (fig. 2), a member of the Dodecanese archipelago, is home to a dense and diverse array of historical and prehistoric remains, stretching from the

Neolithic to the recent past, despite its far more rugged landscape compared to neighboring islands.

Kalymnos itself is composed of three roughly parallel mountain ranges rising from the sea, oriented approximately west-northwest to east-southeast. The middle one of these three ranges is the tallest and creates valleys to its north and south, while the northernmost range creates a long, steep peninsula which projects to the northwest, toward nearby Leros. The northern peninsula and the western coast of the island form a bay, in which sits the mountainous islet of Telendos. The island's rugged terrain divides it into three distinct zones of habitation: the southern valley, which is currently home to the vast majority of the population; the northern valley of Vathy, which is sparsely populated, but has seen extensive farming in its rich soil for millennia; and finally the western coast, including nearby Telendos, which contains a band of small communities along its length, situated on the narrow stretch of coastal hills that in turn back onto sheer mountain cliffs. The northern valley is the most isolated, having no easy points of access to either of the other areas, but is slightly easier to reach from the southern valley. The western coastal communities and the southern valley are connected, but, at the furthest extent of habitation on the northwestern peninsula, the trip by land is quite long compared to the straight-line distance between the two areas.

In addition to the circuity of its avenues of travel, Kalymnos' extreme verticality results in a landscape that even modern vehicles have difficulty crossing efficiently. Most maps of Kalymnos fail to capture its hilliness properly. Only Telendos possesses an actual coastal plain, though that, too, is small. The Vathy Valley contains most of the flat land on the island. Before the seventh century A.D., much of the population naturally centered around flat areas, dwelling

in the walled towns of Embolas in the Vathy Valley, Damos in the southern valley, and Pothaia on the land bridge between Telendos and Kalymnos (Bean and Cook 131-132).

It was during the end of antiquity and the beginning of the Medieval Roman period that Kalymnos' identity for nearly the next thousand years would emerge. After the gradual abandonment of its Hellenistic towns, the most important population center of Kalymnos during late Roman antiquity was the port of Pothaia, praised in older sources for the quality and security of its harbor (Volanakis 62-63). The site of this settlement is much contested, but local tradition and epigraphy indicate that it was located in one of several places: the western coast of the southern valley in the area of modern Mirties or Masouri; the eastern coastal plain of Telendos, where ruins can be seen today; or (most likely, considering the submerged ruins) it occupied the land bridge that once connected Kalymnos to Telendos (Bean and Cook 132). The aforementioned land bridge was submerged by an earthquake in AD 554, and Pothaia with it, after which the two landmasses were separated, and the population outside of the Vathy Valley becomes difficult to locate for roughly one century (Koutellas, "Ta Kastra," 427; Volanakis 62-63). Though a pair of divers featured in the television travel series "My Greek Odyssey" claim to have not seen any evidence of Pothaia in the strait, and the show features a dive during which no ruins are encountered, this is very much the minority opinion on an island famed for a history of deep sea diving, and moreover, the underwater footage reveals a remarkably craggy and rubble strewn seafloor filled with fault-block boulders, which are clear evidence of massive seismic activity, and would mean that the former ground surface was utterly churned, breaking up any structures ("Telendos" 8:50-9:50). The earthquake also destroyed many other communities on the island (Koutellas, "History" 30). During this time, and for many centuries to come, the most significant town on Kalymnos would be the port of Rina in the Vathy Valley,

with its deep water harbor and virtual invisibility to passersby owing to the dogleg shape of the inlet providing access to the port. The only shortcoming of Rina's harbor is its narrowness, but given the size of the settlement, this may not have been a major impediment **(**Koutellas, "Ta Kastra," 429).

Yet the most significant population shift was not in the northern valley, but rather the abandonment of the south, and the concentration of the populations of the western coast and Telendos into a series of three highly defensible fortified settlements during the seventh century (Koutellas, "Ta Kastra," 429**)**. Below, the term kastro (pl. kastra) will be used to refer to these settlements, as the term captures a particularly Roman style of fortification, and cannot be regarded either as an aristocratic residence, a simple refuge, or a walled city (Shimoda 8). Instead, the kastro is a fortified permanent community, with the defensibility of a castle, but serving as a full community, albeit more isolated than typical settlements (Shimoda 8). The issue of whether the Kalymnian kastra were permanent settlements or refuges is examined in further detail below.

The Kastra of Kalymnos

Three of the four Roman fortifications of Kalymnos (fig. 3) were built during the seventh century. These are the sites of Agios Konstantinos on Telendos, Galatiani near the hamlet of Arginonta, and Kastelli on the western coast of the mainland. The remaining Roman fortification, Chora Kastro, is, in its present state, almost entirely a product of the Knights of St. John, with the original Roman structure having been badly damaged in an earthquake (Koutellas, "Ta Kastra," 440). The most intensive investigation of these sites has been in the form of surface collections, and little else has been done. Ceramic evidence indicates these sites were abandoned

at the end of the 10th century, and the population resettled itself in less defensible locations- from Agios Konstantinos to the eastern shore of Telendos facing Kalymnos, and to the area of Chora on Kalymnos proper (Koutellas, "Ta Kastra," 437). Detailed descriptions of the kastra are provided below to orient the reader.

Fig. 3. The kastra and settlements of Roman Kalymnos, from the beginning of the Roman period to the end of the eleventh century. Circles represent cities, triangles represent kastra. Map of Kalymnos, Greece from: "Kalymnos, Greece" Map, *Google Earth.*

Kastelli

Kastelli (fig. 4), the smallest of the three seventh-century kastra of Kalymnos, is located on the western coast, and consists of a fortified promontory of rock surrounded by a second layer of

walls at lower elevation, and long, crenellated walls reaching down to the sea, running north and south of the main fortification. The siting of Kastelli is uniquely impressive, being located on a steep conical hill at the end of a narrow, rocky peninsula with no beaches, thus granting its former defenders a significant elevation advantage over all approaches. From Kastelli, one can see clearly to Agios Konstantinos on Telendos, down much of the western coast to the south, and almost the entire northern half of the western coast as well, with easy sightlines both to Galatiani and Emporio. While this promontory once would have held even greater value, as the end of the land bridge between Kalymnos and Telendos, and thus the harbor of Pothaia, would have once been directly south of the kastro. However, after the sinking of Pothaia, the site no longer protected the approach to a significant anchorage (Koutellas, "History," 30). Regardless, the seventh century fortification had many valuable qualities in addition to its defensibility. It was more accessible than the other two by far, owing to its low elevation and central location, and also the potential to control movement along the entire western coast of Kalymnos from its strategic location (Kardulias 16). Indeed, not only was Kastelli situated perfectly for defenders to intercept any land traffic along the western coastal corridor, it would even have allowed defenders to directly fire on the entire stretch of coast from the peninsula to the mountain cliffs, if the kastro possessed long-ranged artillery. The deployment of artillery will be addressed in the methods chapter, under the appropriate heading.

Fig. 4. The kastro of Kastelli. From the akropolis, the southern sea wall is visible travelling northwest-southeast. Map of Kastro Kastelliou, Kalymnos from: "Kalymnos, Greece" Map, *Google Maps*.

Agios Konstantinos

Agios Konstantinos (fig. 5) is the only fortification extant on Telendos, the mountain-island opposite the western shore of Kalymnos. Though Telendos has a relatively accessible eastern shore with flat, arable land, and easy access to the sea, Agios Konstantinos is located hundreds of meters up on the shoulder of the mountain's north side, with the sheer cliff to the mountaintop at its south, a steep cliff to its east, sharp drop-offs and a narrow access path to the west, and, the only side with practical access, a series of precipitous gullies to the north. Owing to its strategic use of terrain, Agios Konstantinos is entirely secure with only two stretches of wall, one of which prevents access from the northern gullies, and contains the main gate, the other of which is an impressive gate and bastion blocking the already inaccessible western approach to the settlement. Agios Konstantinos is the largest of the three seventh-century kastra, both in enclosed area as well as in quantity of structures, with a great number of cisterns and foundations visible, many of which are partially submerged in a

scree-like scatter, composed of some combination of eroded mountain stones and old building material.

Agios Konstantinos is, from a certain perspective, the most inaccessible of the three kastra; certainly more so than Kastelli, and considering Galatiani's dispersed nature despite its smaller internal area, the sheer density of Agios Konstantinos' population is notable. The visible foundations are concentrated mostly around the still-extant church of Agios Konstantinos and the main gate, leaving the entire western half of the enclosed area very sparsely occupied. In spite of its difficult access, there are many dozens of foundations in the central area of the kastro. Even modern propeller boats have difficulty landing tourists directly below the kastro's gully approach, as its 'beach' is in fact composed of sheer meter-high rough stones, and the only practical approach for large groups would have to be from the coastal plain on Telendos' east coast, following the narrow path between the mountain and the sea.

Fig. 5. The kastro of Agios Konstantinos. Main habitation area is the bottom two-thirds of the right half of the image, with the wall visible to its north, and a cliff and mountainside protecting its east and south, respectively. The wall stops where the northern slope turns fully sheer, but the small western wall is visible at the left of the image, protecting the shoulder of the mountain. Map of Church of Agios Konstantinos, Telendos from: "Kalymnos, Greece" Map, *Google Maps.*

Galatiani

Galatiani (fig. 6) stands atop one of the highest peaks of its range, almost directly north of the terraced bay hamlet of Arginonda. The kastro itself is arguably even more minimalist than Agios Konstantinos, composed of one long wall surmounting the southern ridgeline, wrapping around the steep mountain slope to the west, and ending in a small stretch which blocks off the rough northern approach along the shoulder of the mountain. Inside the walls, there are far fewer structures than at Agios Konstantinos, and the kastro at Galatiani is the least architecturally preserved of the three, by a significant margin; I had long labored under the assumption that Galatiani was composed merely of a north and south wall, due to the remarkably poor condition of the western section, and the writings of archaeologist and local Ephoria office director Michael Koutellas, which describe the wall as protecting the two possible approaches (Koutellas, "Ta Kastra," 65). The western part of the wall is of questionable defensive necessity given its position atop a nearly-sheer cliff, and is currently indistinguishable from aerial photographs, and even to some visitors, who describe the kastro as having multiple walls rather than a continuous circuit (Heslop 39). At present, Galatiani is also the hardest to reach and likely least visited as a result, with a steep mountain climb aided by few paths, the main one of which is prone to erosion (Heslop 39).

Fig. 6. The kastro of Galatiani. The north-south ridge in the north portion of the image adjoins the beginning of the wall's northern portion, which follows the slope around the west side, tops the ridge on the south side of the plateau, and terminates at the eastern cliffside, just south and east of the church of Panagia Galatiani (bottom right, blue roof). Map of Church of Panagia Galatiani, Kalymnos from: "Kalymnos, Greece" Map, *Google Maps.*

Primary Sources

The most important primary sources on the fortifications of Kalymnos are a mix of photographs both from ground and air, written descriptions of their physical characteristics, and personal statements from people who have visited them, in addition to my own experience having visited Kastelli and many other sites on the island. Though not primary sources in the traditional sense, the travel restrictions imposed by COVID-19 have required study of these locations from afar, and, without any ancient statements concerning them directly, the best primary sources are those describing the state of the ruins today, either visually or in text (Shimoda 16).

The primary textual sources for this period are, unfortunately, generally vague and oblique in their references to relevant military matters, barring the turning point that is the Battle

of the Masts (A.D. 655). The military situation of the Aegean islands, being of secondary importance to the terrestrial portions of the themes in which they were located, is not given much attention, and brief references to attacks are mostly all that appear, save for the obvious exceptions of Crete and Cyprus, owing to their size and importance. Arab raids were prevalent at sea and on land, but land incursions receive the lion's share of attention. Thus it is that Kalymnos has extensive fortifications, and yet is absent from the surviving histories, making it unclear to what extent the island was attacked.

The *Chronographia* of Theophanes is perhaps the most famous history of the period, but its focus is generally far from naval matters, and is, understandably, focused on the actions of Emperors, who were unlikely to have taken personal interest in the Dodecanese. As such, it has little direct relevance to the construction of the kastra. Such a perspective is near-universal in chroniclers of the time. Emblematic of contemporary historians' disinterest in the islands is Theophanes' treatment of the earthquake of 554, which he describes as terrible, but only in reference to the destruction in Constantinople, while on Kalymnos, that same earthquake sank one of the island's two cities, and received no mention (Theophanes 335; Volanakis 62-63). If such a dramatic event was passed over by one of the more detail-oriented Roman histories, it is hardly surprising that al-Tabari, Michael the Syrian, and other foreign sources likewise have nothing to say about Kalymnos.

Motivation to Fortify: The Arab Raids

After the Battle of the Yarmouk (A.D. 636), Roman resistance to the Arabs collapsed in much of the Empire. However, once the borders were locked at the Taurus mountains, in 649 a seaborne expedition of Arab troops attacked and despoiled Cyprus, an event which would be

repeated many times; in 650, the result was the fall of Konstantia/Salamis, leading either to widespread destruction or the levelling of fortifications specifically (Michael the Syrian 131; Theophanes 478-479). In a few short years following the attacks on Cyprus, Mu'awiya looted the island of Kos, Kalymnos' longtime administrative superior throughout the Hellenistic and Classical Roman period, tearing down its fortifications, and performed similar deeds on the islands of Rhodes and Crete, as well as on Arados after an initial failure (Koutellas, "Ta Kastra," 428; Michael the Syrian 131; Theophanes 481-482). The famous Battle of Phoinix, or Battle of the Masts to Arabs, was fought soon after these events- The *Chronographia* of Theophanes places the event in 653, the same year as the first fall of Rhodes (Theophanes, 482). The attention that Arab writers paid to fortifications emphasizes their importance in securing islands.

The result of losing naval supremacy to the Arabs was that the annual Arab raids into Anatolia were mirrored by incessant piracy and amphibious raids in the Aegean and eastern Mediterranean (Koutellas, "Ta Kastra," 428). While this phenomenon is given little notice in grand-scale histories, it was so locally devastating that islanders from the Dodecanese to Cyprus refer to the period roughly from the mid-seventh to tenth centuries as the Arab Raids.

The nature of Arab raids varied, and they had diverse goals. Some intended to settle the land they attacked, as seen in the occupation of Crete and parts of Attica, in contrast with the smash-and-grab acquisitions of loot and slaves seen in the siege of Thessaloniki; they were neither purely in pursuit of plunder, nor purely concerned with conquest (Setton 311-312; Kaminiates).

There are no explicitly attested attacks on Kalymnos by Arab raiders in the histories. As such, archaeology is the only possible source of hard dates or evidence. Unfortunately, the first and only potential form of archaeological evidence of warfare on the island itself is represented

by Newton's discovery of a scatter of bronze arrowheads near the basilica of Christos tou Ierousalim, which he interpreted as evidence of arrows being fired, based on their dispersal pattern and their points being blunted as if by impact (Newton 307). Unfortunately, it seems likely that this event, if combat it was, did not involve Arab raiders, as Arabs switched from using bronze in arrowheads to using iron during the Hellenistic period (Hoyland 188). However, there are many surviving examples of Roman arrowheads from the mid-first millennium A.D. of cast bronze; Arab arrowheads of such a type are more elusive (Sermarini Jr.). With Newton's very sparse description, simply stating that the arrowheads are bronze, the furthest assumption that can be made is that they were part of a Roman defense in the area of Damos; in all likelihood, this does not represent warfare of the period and type which would aid in the present study.

Lacking direct evidence of attacks on Kalymnos, comparanda do exist from attacks on the other Dodecanese, as well as other islands generally. The broader context of attacks on Aegean islands must serve as a next-best substitute; besides the obvious case of Crete, there are a handful of smaller, scattered references that will serve as guides to ascertain the degree of threat Kalymnians faced.

Seventh-century Rhodes was attacked both by the Persians and on multiple occasions by the Arabs, with varying degrees of success (Ballance 7). In many of these cases, fortifications are prominent in historical records. For instance, the first fall of Rhodes to the Arabs was accompanied by destruction of its fortifications (Michael the Syrian 142). When Arabs again captured the island in 673, al-Tabari states that they decided to use the main fort on the island as a refuge, set up a naval watchpost, and that the Roman response was primarily to blockade the island's ports, showing a reluctance to confront even depleted fortifications in their own territory

(al-Tabari 166). Additionally, an Arab raid in 807 failed to conquer Rhodes because the defenders of a fortification outlasted them (Theophanes 663). Taken together, these examples show how pivotal island fortifications could be, but also show the amount of strain a garrison could place on the local population.

Unlike Rhodes, Kos seems to have been less affected by Arab raids, at least early on, as the decline of its main port city occurred after the seventh century (Poulou 237, 239). Though Kos was certainly more densely populated than Kalymnos, and thus a harder target, it is noteworthy that the rapid population shift of Kalymnos was not replicated on its larger and wealthier neighboring island. The destruction of Kos' fortifications attested by Michael the Syrian thus seems to have not been as decisive an event or as complete as the description would make it seem.

Even before the devastation of the Roman fleet at the Battle of Phoinix, al-Tabari implies that raids must have been constant. In his record of the year 649, he notes the death of the admiral of Mu'awiya's volunteer naval forces, 'Abdallah bin Qays al-Jasi, who performed more than fifty seaborne raids (al-Tabari 28). Considering that Mu'awiya was only given permission for this venture by Caliph Uthman, since Umar had disapproved of it, these fifty raids can, at most, have taken place over the course of five years, thus, a minimum average of ten per year (al-Tabari 27-29). While this would seem to belong purely in the realm of hyperbole, 'Abdallah's death is strange enough to imply otherwise. Specifically, the story of his death at the hands of local Romans after giving alms to beggars and being exposed by a beggar woman who knew him by his generosity, implies that he must have visited the same place previously (al-Tabari 28). Naturally, this tale itself raises issues, and is probably a fanciful turn on an undignified death at the hands of peasants. Still, the author's assumption that the reader should find it plausible that

‘Abdallah would have become known to the islanders, not simply as a vague menace but at the level of identifiable character traits, implies that ‘Abdallah truly did make a great number of incursions into Roman waters (al-Tabari 27-28). If ‘Abdallah was so prolific a raider, it is hard to imagine he was the only one.

In addition to the vaunted exploits of raiders, the Roman state’s own administrative system implies a truly staggering number of raiding incidents. The *Marcian Treatise* lays out a specific type of land ownership category for property that has been vacated by fleeing peasants, and the specific detail with which this topic is treated, and even said to often be caused by raids, implies that this was something the Roman state dealt with constantly (Neville 40).

Centrality or Periphery

In examining the defensive organization of Kalymnos, and the scale on which its defense was organized, it is imperative to establish just how much attention and support it and other similar islands could have counted on from imperial office-holders.

The Aegean was consistently a nominal part of the Roman Empire throughout the first millennium A.D. However, this alone did not guarantee the region attention or priority, as is reflected in its relatively minor place in the already meagre written records of the time (I. Randall 82). The Aegean islands have always drifted between states of connectivity and isolation. If or when organization is noticeable on a larger scale, such involvement may indicate the Roman “Dark Age” in the Aegean to have been a more connected period than is often suggested (I. Randall 83). As a result, the understanding of Roman efforts to fortify the region inevitably relies heavily on archaeology, while maintaining an awareness of the spotty record of conclusions drawn from material culture in this period and region (I. Randall 84; Metcalf 399).

While unlikely to have attained the relevance of neighboring Kos, Kalymnos was a trade destination nonetheless, even during the Arab raids, when its population retreated into uplands or natural defensive points, and fortified them. Nowhere is this more evident than in the surface collections recovered from the mountaintop fortified settlement of Galatiani, near modern Arginonta, which included, among other things, a ring, lead measures, and scale components and weights used to evaluate the purity of gold coinage (Koutellas, "Ta Kastra," 432). The use of currency generally having declined rapidly throughout the peripheral empire after the Arab conquests, such a scale is important evidence of continuing economic activity; after all, one would hardly need such fine tools to measure out grain or other barter goods (Whittow 90). If even an isolated mountaintop such as Galatiani had inhabitants who were making use of gold coinage, it stands to reason that the islanders' defensive posture and the threat of Arab attack was no hindrance to Kalymnian interaction with the Roman government, and likely broader trade networks as well (Whittow 90). While coinage was always of use in paying taxes, and the collection of it is evidence that these probably were tax-paying citizens, the scales imply a concern with the worth of coins, rather than just their quantity. If coins are being amassed only to pay the taxman, few would be concerned with the quality of those coins, as the only point at which purity of coinage might change the transaction (barring forgery) is if the coins are obviously worthless and debased. Instead, the concern with gold purity implies interest in coins as units of exchange, not just for fulfilling government obligation, but for amassing wealth. After all, Roman coinage, despite its central control, often was worth more than the gold it contained, and such a system allows for variance (Neville 9). Moreover, it is a well-known economic principle that, when people hoard money, they hoard the best money; this is half of the 'bad money problem.' Such hoarding, especially with gold coins before the advent of modern

precision machinery, would be greatly aided by a set of scales. With this in mind, the initial image of cloistered villages hidden away from raiders and remote from imperial ties begins to look incomplete.

Refuge Fortresses vs Fortified Settlements

Despite only having one Roman fortification that is always referred to as *kastro* (Chora Kastro/Castle) the Roman fortifications of Kalymnos all fit the term. In the period in question, *kastro* describes not a castle, as it is often translated, but rather a fortified settlement, not necessarily on the scale of or supplanting an urban center, and with relatively formidable fortifications and siting (Shimoda 8). The persistent interpretation of *kastra* as primarily places of refuge runs counter to much of the evidence from Kalymnos, and has been contested in analyses of fortified islands in the Saronic and Korinthian Gulfs (Kardulias et al.; Gregory).

The three seventh-century fortifications of Kalymnos each have a number of houses within them; Agios Konstantinos has the most, Galatiani the second most, and Kastelli the fewest. Considering their locations near the sea and the number of dwellings within each, it is obvious that these were true fortified settlements, and not mere temporary refuges (Koutellas, "Ta Kastra," 434). Moreover, surface finds collected by Koutellas ("Ta Kastra," 435), the most diagnostic of which are various local ceramics, suggest habitation in these three settlements lasted until around the tenth century (Koutellas, "Ta Kastra," 435). If the need for refuge was so considerable that one island featured three of them, yet people had their permanent dwellings elsewhere, one would expect some form of fortification to appear around that community as well. At the very least, such fortification would serve as insurance if one cannot reach the fortified sites, which are relatively remote from the fertile regions of the island. However, no

extant remains suggest that any other fortifications (or towns other than Rina) of note existed during this period. The walls of Embolas and Damos were likely in little better condition than they are currently, save for a few blocks here and there used in churches, and the Hellenistic fort of Kastri is small and difficult to reach. Rina was continuously inhabited owing to its fertile soil and the protection of its narrow-mouthed dog-leg harbor, but it lacked walls, and was on the other side of the island, separated by many kilometres and at least one mountain range from any of the major fortifications--undesirable traits in a refuge to which one must flee (Koutellas, "Ta Kastra," 429). As such, the contention that the three fortified locations are permanent settlements is difficult to dispute.

However, it bears mentioning that the order in which the components of these sites were built, i.e. dwellings and then fortifications, does not have sufficient archaeological data to be ascertained with certainty. This paucity of hard dates brings into question the nature of these sites, opening up the potential that they were already inhabited, and merely received fortifications in response to the Arab threat. Nonetheless, it seems very likely that the three locations were at least chosen with defensibility as a primary consideration, and thus that fortification would have followed soon on the heels of settlement, if the two types of construction were even temporally discrete events in the first place. The obviously difficult approaches to each site, and location far from any beaches, would make them foolish choices as simple dispersed resettlements of old Pothaia's population. Galatiani is the clearest example of this, having seemingly nothing to recommend the site other than its defensibility and excellent sight-lines. Thus, it stands to reason that these were places chosen to be fortified.

Beyond the location alone, architectural evidence is highly instructive in establishing the contemporaneity of houses and fortifications. Roman citizens and officials often preferred to

incorporate existing buildings into any impromptu fortifications, as was done in an unsuccessful attempt to defend Cypriot Salamis/Konstantia from the Arabs in the 650s, and had been done long before (Lawrence 201). Indeed, even a prosperous city like seventh-century Side readily incorporated architectural remains into new walls when possible, and thus it is unlikely that a much smaller community would have neglected to do so if such architecture was present (Lawrence 201). The western portion of Galatiani's wall curves to follow the contours of the cliff upon which it stands, placing most portions of it on steep terrain, unfavorable for construction. However, one of the settlement's largest houses is built sharing a side with the fortification wall (Koutellas, "Ta Kastra," 432). Taken together with the style of fortification used elsewhere to defend an already-existing settlement, it is clear that Galatiani's houses were built, at the earliest, concurrent with the defensive walls, and could well have been built later, as such a large dwelling would be far easier to build on the flatter portion of the mountain, unless the wall already existed, thereby making the calculation favorable due to the need to erect only three walls. In addition, the wall would have been more expediently built if it had followed more level ground in order to exploit more house walls and flatter terrain, which would not have hampered its effectiveness significantly due to the nearby cliff, and decreased the effort required to build it; this implies that the houses did not yet exist to represent a potential mitigation of costs. Considering the wall's relatively rough and steep path on the west, it is thus likely that the majority of houses were completed after the wall's construction.

The cisterns of Galatiani and Agios Konstantinos both support similar conclusions. While Kastelli is a small conical hill, Galatiani and Agios Konstantinos are built on a mountaintop and high on a mountain slope, respectively. With this in mind, the location of all of the cisterns of each site within the defensive walls, which follow natural contours, would seem unlikely if the

cisterns predated the walls. This is because cisterns are more efficient at collecting water the further down a slope they are, and Agios Konstantinos even features several natural gullies which would funnel winter rainfall, allowing for greater water collection downstream (Mays et al. 1921, 1929). The fact that this advantage was not exploited by even a single cistern at lower elevation in the case of either fortification suggests that the wall existed by the time of the cisterns' construction, because while the walls exploit the most beneficial topography for their type of structure, the cisterns do not, and they clearly only appear within the walls.

Finally, though divorced from the other three *kastra* by a significant gulf of time, Chora Kastro represents a very clear example of a Roman fortified settlement built as such. Unlike its seventh-century counterparts, Chora Kastro's construction is part of a broader Aegean trend of new fortifications in the eleventh century, in response to intense Seljuk naval raids from Smyrna under the chieftain Tzachas, which occurred in the last quarter of the century (Koutellas, "Ta Kastra," 441). Chora Kastro was certainly no ramshackle refuge, since its current clifftop walls--which likely overlie the Roman ones as no foundations are evident for them elsewhere--encompass an area large enough for 1,200 inhabitants, and likely more under the duress of a siege (Koutellas, "Ta Kastra," 440). While Koutellas contends that the Knights' rebuilding after the destructive earthquake of 1493 is what gave the fortification its current shape and size, this hypothesis requires a reconstruction effort that would have been unheard of in its thoroughness, entirely removing even previous, usable foundations and remaining components of the old wall, and rebuilding every single house from scratch in a new configuration (Koutellas, "Ta Kastra," 441). Moreover, Koutellas argues the difference in the Roman fortifications by noting their absence on a fifteenth-century map predating the reconstruction. However, the map of Kalymnos found in Bartolomeo Dalli Sonetti's *Isolario*, drawn in 1485 and thus also predating

the reconstruction, depicts what appears to be a fortified hilltop settlement in the approximate location of Chora Kastro (Sonetti).

In fact, the English name Chora Castle is quite inaccurate, as it is a thoroughly walled town on top of a steep-sided promontory, rather than a simple castle, and it is a town that could accommodate some 1,200 inhabitants, with numerous structures evident even today (Koutellas, "Ta Kastra," 440). The construction of Chora Kastro in the eleventh century followed closely on the heels of the abandonment of the three other fortified settlements; judging by its current clifftop walls being the only set of walls to have any visible remains, the Roman walls must have stood on the same spot, encompassing a similar internal area to the one currently visible (Koutellas, "Ta Kastra," 441).

Building Program vs. Local Response

At first glance, Kalymnos and other similar islands would seem to have been well beneath the notice of officials and wealthy benefactors, barring some sort of catastrophe. While at first the idea of Kalymnos occupying the minds of the imperial court seems dubious, the evidence of trade indicates that Kalymnos was no unvisited backwater either. As such, the fortresses' origins come into question.

The timeline for the fortresses' construction thus becomes of key importance. The consensus for a date of construction seems to rest on the seventh century A.D., and quite reasonably so given the Arab incursions. However, a shift of a few decades in either direction can provide valuable additional context. If some or all of the fortifications had been built in the very early eighth century, they could well have served as a response to the famous Arab siege of Constantinople of 717-718.

Additionally, the motivations for the construction may shed further light on the issue. Several hagiographies mention as background detail that islanders were terrified of Arab raids during the seventh century, providing ample cause to lend their labor to fortification efforts (Christides 1332-3).

Chain of Command in Fortification

Kalymnos' place within the Roman state, like many other places throughout the empire, changed throughout the evolution of the theme system. Originally in the Karabisianoi fleet, Kalymnos changed hands with the eventual emergence of the Kibyrrhaiotai in the early eighth century (Oxford Dictionary of Byzantium 1127).

Unlike the fortifications of the Knights of St. John on the island, Kalymnos' Roman fortifications have no clear designated sponsor or commissioner. As such, there are three possibilities that must be considered as to the origin of the command to build the fortifications: that the order for their construction came from the Emperor, from an officer below the throne (i.e. strategos or lower), or that they were constructed due to a decision made by the Kalymnian community, be it only the western shore and Telendos, or the entire island as a whole. Moreover, the origins of the resources used to construct these fortifications and new settlements, including funds, raw material, and labor, could have come from or been supplemented by any of the aforementioned authorities.

Theophanes rarely attributes the construction of forts to any agent, but when he does so, it is inevitably to an Emperor, and used as part of an ongoing or shakily concluded land campaign (Theophanes 617). Theophanes gives similar attribution to reconstruction efforts,

stating that Emperor Nikephoros rebuilt the forts destroyed during an Arab raid in Anatolia in the early ninth century (Theophanes 664).

The most obvious physical evidence against imperial sponsorship of the Kalymnian kastra is the rough quality of their stonework. Shimoda notes that, in the Roman Morea, fine ashlar masonry with extensive mortar was likely the product of imperial work; conversely, the small, rough-cut stones of the Kalymnian kastra make an imperial origin unlikely (Shimoda 59). Naturally, this does not preclude the possibility of imperial funding simply being small or spread around, as the three fortifications would have required a significant amount of labor. However, if the Emperor sponsored a project, its results would impact his standing, and the cobbled walls of the kastra in question hardly seem like demonstrations of imperial largesse (Shimoda 35).

Indeed, Samos was the target of an imperial reconstruction period in the 830s, and, despite the gulf of two centuries, the stark differences in comparison to the Kalymnian kastra are still notable. Samos' Kastro Tigani was restored with precise ashlar masonry and fine brickwork, and bore a dedicatory plaque proclaiming Theophilos' patronage and power, thus ensuring that all knew who was responsible, and where their loyalties should therefore lie (Lauxterman 272-273). The fact that Kastro Tigani is one of the few island kastra that was explicitly an imperial project demonstrates that the defenses of the islands were likely of little concern to Emperors. For Samos to have been uniquely favored, it needed a singular quality, and that was its fleet base, i.e. its great value both in defensive and offensive operations. Judging by the state of Kalymnian harbors in the seventh century, with that of Rina being a narrow defile, and little significant infrastructure evident on the west coast or on the shores of Telendos, it likely lacked sufficient military potential to justify imperial interest in its defense.

Instead of the Emperor, it is possible that a strategos or similar high officer may be responsible for the order to construct the Kalymnian fortresses. Such an officer would almost certainly be of the Karabisianoi fleet, if the kastra are indeed from the seventh century, but Kalymnos later was part of the Theme of the Kibyrrhaiotai after the early eighth century (Oxford Dictionary of Byzantium 1127; Pryor & Jeffries 25). Thus, three major possibilities present themselves. First, the fortifications may predate the establishment of even the Karabisianoi fleet and are thus part of an entirely different command structure; second, the Karabasianoi may be responsible; third, the fortifications may be slightly later, and created under the Kibyrrhaiotai.

If the fortifications predate the Karabisianoi, they would only do so by a very narrow margin, as Pryor and Jeffries as well as Christides contend that the fleet was established after the defeat at the Battle of the Masts (Pryor & Jeffries 25). The primary sources do not state the specific year of the fleet's establishment, but its first textual mention is around 680, providing a terminus ante quem (Oxford Dictionary of Byzantium 1105).

While dates from ceramics in the Kalymnian *kastra* have only been narrowed down to the seventh century, more precise numismatic dating has revealed generally earlier chronology for the similar fortification of Emporio on Chios (complicated by continual occupation of the site previous to its being fortified) (Ballance 7). Emporio was fortified during the reign of either Heraklios or Konstans II (610-668), which opens the possibility of a wave of military construction in response to the Persian attack on Rhodes in 622/23, rather than the raids of the Arabs, however remote such a possibility is (Ballance 7).

The likeliest possibility is that the fortifications were erected under the Karabisianoi. This possibility likewise makes the greatest sense for external funding of the construction efforts, as the Karabisianoi fleet, and thus its head officers, was headquartered at Samos, a mere 160 km

from Kalymnos, whereas Attaleia (headquarters of the Kibyrrhaiotai) is more than twice that distance as the crow flies, and even further by sea (Pryor & Jeffries 25). Moreover, the defensive logic for fortifying islands is stronger under the Karabisianoi, as Kalymnos would be on the opposite side of Samos from Constantinople, and thus would have likely been beyond the most intensely patrolled areas, and any attacks would be less likely to be intercepted. On the other hand, the Kibyrrhaiotai being stationed at Attaleia meant that, by the eighth century, Arab raiders from the Levant would have to pass by one of the largest Roman naval bases in order to reach the Dodecanese, making the intensity of raids to which Cyprus was subjected quite understandable. Indeed, while the Kibyrrhaiotai fleets were active in interdiction efforts, those efforts did not extend significantly into the Aegean, and enemies that got past were unlikely to be taken until the return journey (Leontsini 174-175). If word only reached the Samian fleet yards once the enemy was nearly upon Kalymnos, it would have been very hard for the imperial ships to catch them before significant damage was done. Fortifications and ships were some of the most expensive military projects of their time, and thus construction of the Kalymnian kastra should have avoided wasting these resources; if the fleets were moored at Samos, they would have little hope of interdiction against craft of equivalent or greater speed, but, if the enemy were held in place attempting to take hard targets, the fleet would prove far more valuable as a military asset.

Sailing from Samos to Kalymnos was by no means a short journey in seventh-century ships. Pryor and Jeffries figure average galley travel speed at 2 knots (3.6 kmph), and calculate the victorious Cretan expedition of the 10th century at speeds between 2.4 and 4.6 knots (4.44-8.52 kmph) (Pryor & Jeffries 333). Even assuming the highest suggested speed, a fleet would take slightly less than nineteen hours of continuous sailing to cross the straight-line distance between Kalymnos and Samos; add to this the fact that no such voyage would actually

be in a straight line, the delays involved in relaying news of enemy attack, drawing up response plans, provisioning ships, gathering sailors, launching the ships, and ensuring the force is ready to move as one, the resultant response time would grant any Arab raiders a substantial window of opportunity to pillage to their hearts' content.

Under the theme system, small-scale fortifications to protect valuable trade goods were possibly created on the orders of high officers. Ballance (6-7) asserts that the short-lived Kastro at Emporio on Chios functioned partially to secure the trade of mastic gum; if such a mercantile approach to fortification was indeed practiced, then Kalymnos may likewise have been given greater consideration for its even rarer export of sponges. Of course, this assumes the antiquity of the Kalymnian sponge trade, which, owing to the great perishability of the tools and products of this trade, is all but unverifiable archaeologically. Moreover, as mundane goods, sponges are not a primary concern of historical records. Another possibility, lent credence by the remote locations of two of the kastra, is that their sites were chosen partially for access to lumber. As the Roman economy was restructured during the seventh century, a high priority was placed on supplies for building and maintaining fleets (Leontsini 178). Though Kalymnos is now fully denuded of virtually all natural tree growth, this may not always have been the case, as evidenced by Sonetti's *Isolario* depicting Kalymnos partially forested (Sonetti). The remote mountainsides and least populated stretch of the already sparsely populated western coastal lane would have been far more attractive if their remoteness meant they had access to sources of wood, which are otherwise few on the island. Though the benefits of forestry would not be exclusively recognized by thematic commanders, the existing precedent is thematic in origin.

Thematic dates are put forward by Heslop, as well as Bean and Cook, albeit both argue only for Kastelli being later than the others; the arguments hinge respectively on a subjective

assessment of the quality of the construction, and a very vague orally transmitted tale (Heslop 41). Heslop's argument that Kastelli's walls are far finer than the others omits that Kastelli is nonetheless still far from an architectural marvel, and is only distinctive in that the walls of the other two kastra are even rougher. More importantly, the argument that higher quality stonework is an indication of a later date conveniently ignores the fact that the much earlier Hellenistic fortifications of Kastri, Embolas, Damos, and Kastellas all have much finer ashlar masonry than any of the seventh-century kastra. Moreover, Kastelli's fortification would have good reason to be the strongest even if built contemporaneously, as its outer walls are the easiest to approach of the three fortifications, and its position near sea level and without a significant rise to protect its entrance would logically encourage its builders to make up the gap by other means. As for the anecdote, Bean and Cook claim a ninth-century foundation for Kastelli by refugees from Rina, on the basis that "it is said" to be so (Bean and Cook 132). Even were this more thoroughly cited, it is worth noting that another popular tale about Kastelli involves the castle's princess and her forbidden love for a young man in Pothaia causing the earthquake that collapsed the land bridge, destroyed the city, and made Telendos an island. Thus, the folklore about Kastelli places its construction within a broad window of about three centuries, and its inhabitants were either royalty of some yet-to-be-rediscovered kingdom, or refugees cobbling together masonry far more efficiently than people with homes and food in their bellies. In short, both Heslop and Bean and Cook's claims of later dates are extremely shaky, and, in general, a thematic origin for Kastelli has little in the way of solid proof.

In fact, the only dramatically superior stonework within the seventh-century kastra is found in the western wall of Agios Konstantinos, which possesses thick walls and large ashlar masonry, much more fitting for an imperial construction effort (Newton 318). However, Newton

reports secondhand that locals refer to that portion as Hellenistic; considering it is just one wall, and protecting the far more inaccessible route to the kastro at that, it seems unlikely that the west gate was a fortification all its own (Newton 318). Though likely not a complete Hellenistic fortification, and no other remnants of Hellenistic fortification of similar style are present on Telendos, the west wall also differs markedly enough from the rest of Agios Konstantinos that a later date is not out of the realm of possibility. Another strong possibility is that the west wall made use of spolia from some small, self-contained Hellenistic fortification nearby, which has either evaded notice or been destroyed.

This, however, brings additional challenges: namely, that the Strategos of the Kibyrrhaiotai, at least by the early ninth century, was only ranked eleventh out of the eighteen contemporary strategoi, and considering the theme's focus on naval warfare, which was generally less important to the Empire, it is unlikely that the Kibyrrhaiotai was much more prestigious during the eighth century (Pryor & Jeffries 390-1). Later texts reinforce the sense of the Kibyrrhaiotai's low importance. *De Ceremoniis* indicates that the Strategos of the Kibyrrhaiotai was one of those who received the minimum payment afforded to a strategos, a mere ten pounds of gold annually, while the *Taktikon Benesevic* of the mid-10th century places the Strategos' importance at twenty-first out of thirty-eight (Pryor & Jeffries 391). Even though the kastra almost certainly predate the Kibyrrhaiotai, the relative unimportance of the region as part of the Empire's defenses, as indicated by the salaries of its later protectors, can be extrapolated to earlier periods.

As for the possibility of the construction being locally motivated, there are three possible forms such motivation might have taken, presented here in order of least to most likely. First, these fortifications could have been ordered by a single prominent wealthy local or very small

group to consolidate power while meeting the threat of raids, while exerting control over the island's population, or by empowered officials as protection for assets they claimed. This more selfish motivation, of course, relies on a great deal of wealth being present in Kalymnos independent of imperial salary. This may have been the case considering the finds at Galatiani, but the scale of the kastra would represent a considerable cost; such private fortifications were rare within the Empire, where defensive works were often manifestations of authority (Neville 39-40; Shimoda 35). Additionally, the dispersed pattern of the settlements would make little sense unless multiple such people collaborated in their goals, but not enough to agree on a common site. Overall, this explanation is rather flawed, but not impossible, considering the potential value of sea trade for the island.

The second possibility is that the kastra were funded by a local imperial official on behalf of the Kalymnians, which represents a more justifiable use of salary (such as it would have been), and explains the seeming concurrence of houses and walls. On the other hand, this explanation still requires either significant expenditure, which may have exceeded such an official's wealth, or convincing the people to labor at a discount, a potentially unacceptable risk for commoners when moving to the Vathy Valley remained an option. Moreover, such an official would be hard pressed to oversee or in any way control the construction of three fortifications which even today are at least an hour apart by car and ferry, let alone by foot; one site is atop a mountain, and another requires crossing a channel. The best evidence in favor of this origin is the coordinated and intervisible nature of the fortifications, which look to have been built with some level of military expertise. Considering that Roman officials in charge of territory were almost always military commanders as well during this period, the level of coordination evident in the plans implies that a military officer at least had a hand in organizing, coordinating, or planning

the features of the fortifications, regardless of what their specific origin was. However, given such an official's duties would have involved naval warfare, it is still unlikely that they would spend time and resources paying for and directing such small and disparate communities.

The third and final possible explanation is that the efforts were the product of collective action, and that there was no order to fortify, but rather that people moved of their own accord, congregating in defensible places, and building walls to defend themselves. This explanation benefits from a decreased reliance on personal expenditures, as higher officials would essentially be subsidizing and directing an ongoing population movement, with people under their own direction more likely to work cheaply or for free. Fear of the Arabs may have been a motivator. Raids, after all, are partially intended to demoralize the enemy, and if Kalymnos had been subjected to a raid while undefended, a communal effort would be all the more salient. Moreover, despite the excellent siting and fortification of these sites, and their possession of large, public cisterns, the actual organization of houses and household cisterns inside is as chaotic as any village, and the small cisterns are highly distinct from the large (probably communal) ones (Koutellas, "Ta Kastra," 437). All of this indicates that these fortifications were planned, while the settlements inside them grew more organically. Assuming that the same people built everything, and that nobody paid the cost of bringing in large crews of expert masons, this marked difference in architectural priority and level of organization is a logical result of a populace's work being primarily self-motivated, but directed or aided from above. This explanation accounts best for the dispersal of population across the three fortified settlements, because the most cost- and labor-efficient decision for an effort directed by a single big spender would be to resettle in a single large place, requiring less fortification effort in total than the sum of the three extant locations. Thus, any aid would have been supplemental or

advisory rather than foundational. The final piece of evidence suggesting this is the notable lack of engraved dedications at any of the three kastra. Considering the use of imperial dedications elsewhere (e.g. Samos as mentioned above), and the presence of multiple heraldic dedicatory reliefs on the two post-Roman castles (the modern Chora Kastro and Chrysocheria), their absence from the three seventh-century fortifications is conspicuous enough to suggest no single individual could reasonably claim responsibility for their construction.

Regardless of the ultimate source of the order to build, the dispersal implies that work must have been, at least on some level, locally motivated. For instance, Telendos has little to warrant being so heavily fortified, or even continue being inhabited to any significant degree, unless there were already people living there in the process of moving away from the coasts.

In sum, the textual evidence suggests that the Kalymnian kastra were much more localized projects than the grand constructions that historians attribute to emperors and strategoi, possibly created by an officer of the Karabisianoi, but much more likely built entirely on the initiative of the Kalymnians, perhaps with minor external aid.

Conclusion

The three seventh-century kastra of Kalymnos and Telendos represent the greatest window into the lives of these islands' inhabitants. More broadly, these sites have great potential to aid in reconstructing the details of Roman fortification strategies and approaches in the face of one of the most devastating blows the Empire ever suffered. Though the histories generally bypass Kalymnos, its storied neighbors provide valuable comparanda, and extrapolations from historical data provide an opportunity to understand the threats Kalymnians (and Aegean islanders more broadly) faced, and to what degree they might have been considered worthy of

aid by outside benefactors. Though Kalymnos was almost certainly raided, and it was by no means cut off from the outside world, it was still peripheral by comparison to wealthier neighboring islands, making judgements about the origin of the building program difficult. Even though it is unlikely that the kastra were refuges, without solid evidence that people were dwelling in greater numbers outside their walls, as a result of the island not having been fully archaeologically surveyed, the refuge concept cannot be fully dismissed out of hand. Finally, the degree of local versus external influence in the building of the kastra is difficult to determine, but it can be safely ruled out that the projects were ordered by the Emperor, and, even if they were built entirely on local initiative, it is almost certain that military expertise went into their construction, whether from higher up the chain of command, or from experienced locals. Much of the writing about the kastra of Kalymnos exudes an air of assuredness, despite the lack of extensive study. Thus, even though this chapter creates more questions than it answers, perhaps that is for the best.

Chapter 2: Theory

In examining decision-making of people many centuries removed from the present, analytical frameworks based in broad utilitarian logic represent the most appropriate way to interpret the fragmentary evidence. This study relies heavily on a materialist, formalist analysis of the fortifications of Kalymnos (LeClair 1188), situating the structures, their builders, and their inhabitants, in primarily tactical and secondly economic landscapes, through the lens of landscape archaeology (Ashmore & Knapp 4-5; Athanassopoulos & Wandsnider).

Landscape archaeology is based on the understanding that an area's landscape has significance to its inhabitants far beyond the physical topography, and the meanings assigned to it and evaluations made of it vary based on context (Ashmore & Knapp 3-5). While landscape archaeology contains many different ways of viewing an environment, the primary concerns of this study will be the economic and military/tactical landscape of Kalymnos. Specifically, the economic landscape of Kalymnos is understood first and foremost as an island with difficult overland passage, and thus the most important component of the economic landscape is proximity to the sea broadly, and to landing sites more specifically. The secondary concern of the economic landscape is access to specific resources, of which the most important is building material, followed closely by water, which, owing to the lack of natural sources, is a key consideration of each site. The rocky landscape of Kalymnos, when understood as an economic landscape, suddenly becomes one of tremendous costs and opportunities, where soft stone overlies much harder material, efficiency of transport is drastically altered by the method used and is often very low, and old ruins with fine stonework abound, but often in out-of-the-way places. While the question of spolia is not fully settled, it is interesting to note that the tactical landscape often became part of the cultural landscape, as many a church on Kalymnos is built

from pieces of old fortification walls, and one is even a fortress itself. Fresh water is a very temporary feature of the Kalymnian landscape, but, owing to the sparse vegetation, its impacts are drastic. The paths water takes were of incredible importance to premodern Kalymnians, for whom large cisterns were a necessity of survival; small, wonder, then, that the most impressive buildings by far (save churches) at each of the kastra are their cisterns, which often compete for the largest structures as well, and always come in multiples. Of tertiary concern is the productivity of the landscape, given far less emphasis owing to the simple fact that there is essentially no evidence from which to work, due to the extreme durability of terrace walls, which mean the kastra could be situated right next to their original farmed plots, or the terraces could be mere decades old; without at least a survey, or better an analysis of soils, there is no evidence upon which to apply this framework.

The military landscape of Kalymnos is both the most granular in its understanding of topography, as well as the most abstract in terms of its utility. The granular quality of the military landscape is a result of the highly varied and rough terrain of the island, where small ridges, steep banks, and sharp drops can result in two parallel-running gullies being drastically different tactical environments, one of which is perfectly suited for defense, the other of which is far less advantageous. The tactical landscape must be understood at all the levels on which the technology and defensive strategies of the Kalymnians were capable of operating. At the grandest scale, the tactical landscape is altered at the speed of light, as the sightlines of watchmen, obscurement by terrain, and communication via signal fire or smoke have the potential to fundamentally shift the nature of a battlefield, where an enemy can encounter unprepared villagers, or a ready and waiting defending force. Though the digital elevation models available for the region lack the resolution to allow examination of it in GIS, the tactical

landscape is fundamentally dominated by sight at the smaller scale as well, where a defender's available targets, their profiles, and the available angles of attack all rely first and foremost on visual confirmation. The tactical landscape can also be simplified down until it is simply various degrees of inhibition of movement, or, in perhaps its most detailed manifestation, as all of the various non-human or armament factors affecting engagement between combatants, from obvious factors such as cover, elevation, and footing, to even seemingly inconsequential details, such as the position of the sun and the resultant shadows and reflections, the impediments deflecting a cooling breeze from reaching tired warriors, or even the coriolis effect ever-so-slightly altering the expected course of projectiles. Put simply, there is tremendous variation in the tactical landscape, but the primary considerations which will be focused upon are visibility, both at an island-wide and an engagement scale, difficult terrain and beneficial positions (almost always for missile weapons), and transportation and travel.

Owing to the tremendous gulf of cultural context and time between this study and its subjects, a formalist approach underlies all evaluations of decision-making. The time of the Arab raids was one when island populations would likely have been concerned first and foremost with survival. Thus, the most obvious motive to assign to decisions is one of minimizing expenditures while maximizing benefits (LeClair 1188).

It bears noting that a simple cost-benefit analysis based on survival becomes complicated due to the non-fortification building activities of the Roman Kalymnians. Like many Greek islands, Kalymnos possesses a staggering number of churches, many of which survive only as foundations. Some of these churches were possible erected during the period of the Arab raids, and often far away from known population centers of the time. Moreover, these churches could even be built of finer material than the fortification walls of the kastra. As a natural consequence

of the Christian Roman tendency to catastrophize and emphasize piety in the face of disaster, church-building was simply another avenue of attempting to better one's situation. Notably, each kastro contains a church (Agios Konstantinos' eponymous basilica would have been huge), and many of the island's late antique/early medieval churches are located in the safer Vathy Valley. Indeed, quite a few prominent churches were abandoned during the seventh century on the mainland; it seems that the impulse to build churches was not stronger than the need for physical security.

Under a formalist analysis, the kastra are already remarkably efficient, suggesting that the model is an adequate one for these specific sites. Put simply, they enclose large living areas with relatively small volumes of wall, while also creating fearsome defensive positions without even substantially altering the landscape. Moreover, considering the kastra were likely local developments, and thus lacking the investment in symbolism of an imperial project, there is all the more reason to view them as the result of the pure drive to survive; in such instances, a model that looks purely to resource investment and return becomes very applicable. For those at the bottom of Maslow's Pyramid, the only thing that matters is the climb. The bottom line is to assume pure utilitarian rationality, and, when results differ, attempt to find meaning in the deviation.

Chapter 3: Materials and Methods

Apart from textual sources, the second main form of evidence in this study is drawn from spatial analysis involving maps and photographs. The following chapter proceeds from a discussion of methods involving direct examination of maps, to then discuss methods increasingly reliant on GIS analysis. A 'grain of salt' approach would best characterise the methods used in this study, as the mathematical logic of ArcGIS often required checking against real-world circumstances. Below, I describe the approaches used in identifying sites, sourcing building materials, performing terrain and route analyses, and determining firing positions and weapon ranges of the kastra.

Site identification

Kalymnos' many fortifications were identified through a combination of approaches, relying heavily on anecdotal evidence of positioning provided by Dr. P. Nick Kardulias of the College of Wooster, and my own experience on the island. Such lines of evidence were useful in locating the pre-Roman sites of Damos, Emborio, Vathy, and Kastri, the Roman sites of Kastelli, Agios Konstantinos, and Chora Kastro, and the Latin site of Chrysocheria. However, locating the pre-Roman sites of Kastellas and Embolas, the Roman site of Galatiani, and various satellite features of sites not personally visited required wholesale reliance on external sources, and piecing together locations from small-scale maps, imprecise descriptions, and even travel blogs. This portion of the study consumed a large amount of time, due to the often degraded nature of these remains. The identifications were made using the highest-detail satellite and aerial imagery available, which, for Kalymnos, was Google Maps, by a significant margin of clarity.

Google Maps was also used as a reference for discerning features when performing operations in ArcGIS, due to the significantly higher degree of clarity than the basemap, which was drawn from Google Earth. Many of the aerial images presented throughout the text are taken from Google Maps as well, due to the greater resolution.

Material Sourcing

As a component of site identification, attempts were made to locate the source of raw material used in the fortifications. This accommodates the possibility of stone blocks being shipped in from abroad or even from other portions of the island, while also representing, in the closest proximity, the easiest approach to the various sites. Special priority was given to the various cost-paths, as they suggest the easiest access, and thus likeliest route for material. Moreover, the cost-paths have the added benefit of starting at the shore, since transporting stone in bulk would be far easier by sea than by land, and thus is potentially the more likely method of transportation.

To refine the search for Roman quarries, the two Hellenistic sites with likely quarries, Damos and Kastri, were used as comparison. In both cases, the suspected quarry practically adjoins the fortifications, and so special attention was paid to the immediate vicinity of the kastra.

It bears noting that the assumed quarry for Kastri is only likely in comparison to the other sites (besides Damos) which lack any clear clues. The assumption of a quarry for Kastri is based on personal observation, and noting that the stone of the cliff walls often adjoins the ground in an unnaturally angular manner once it gets close to ground level. Kastri's angular portions of stone could (though unlikely) be natural, or (less unlikely) simply be for the purpose of ground

levelling, since stone structures once stood inside, including an olive press. The justification for Kastri as a quarry is expanded upon later, but it should be made clear from the outset that even these sites are potentially suspect, and yet are also all there is to go on.

In order to test the possibility that some of the kastra may have been built purely from natural rubble, wall measurements will be combined with measurements of scree slopes in order to obtain a rough idea of whether such a construction technique would have been practical with local stone supplies.

Terrain and Route Analyses

Kalymnos is an island seemingly built to defy the use of digital elevation models, with a combination of gentle slopes and precipitous drops that makes the accuracy of a digital elevation model (DEM) for any site not personally visited highly suspect. Even the finest resolution DEM obtained still greatly smoothed many of the rougher contours of the real landscape. While this has obvious effects in reducing the accuracy of viewshed, cost-paths, and other analyses, the author has taken every pain to check these against eyewitness accounts or photographs of the terrain for accuracy.

In order to calculate routes of travel for military forces, least-cost-paths were used, taking into account DEM data and correcting by hand where the results were impractical. Unfortunately, the low resolution of the DEM meant that high-detail cost-pathing was not possible, e.g. attempting to determine the easiest crossing of the Kastelli peninsula, or the easiest way to approach Kastelli's stairs to the upper bailey.

Route analysis for the fortresses assumed threats to the island would come from outside, as there does not seem to be any historical indication of armed conflict between polities on the

island. Thus, obtaining landing zones also presented unique methodological challenges. Landings were sorted into two categories- those that were (presumably) accessible throughout the island's history, and those that were only accessible after the sinking of the Pothaia isthmus. Most of these landing sites were selected based on beaches visible from satellite photography, and where possible have been personally viewed to ensure they are at a reasonable slope; many are confirmed locations of access from ancient times (Bean & Cook 130-133). However, to identify additional landings, two approaches were cross-applied. First, a dataset containing polygons which identify all the modern beaches of Kalymnos was obtained and checked against the identified landings; other than the two western sites on Telendos, all identified landings lined up with modern beaches. Second, using military analytical think tank Global Security's guidelines on amphibious landings, shoreline areas with a gradient between 1:15 and 1:60 were mapped, resulting in a boolean map of beaches with landable inclines (Pike 1993).

The reasoning behind using slope as the primary element of landability is tied to the types of vessels employed by the Arabs. Arab vessels of the seventh century were primarily shalandiyat, monoreme vessels of very similar form to the contemporary dromon (Konstam & Dennis 32). Both navies later diversified as their mainstay vessels evolved into biremes, creating new ship types to fill the light and low-manpower role; the Arabs developed galeai, which were notably light and swift (Pryor & Jeffries 190-191). The light vessels of the seventh century, with lower manpower and shallower draughts, would likely be able to come very close to shore, if not beach directly; considering how much more expedient embarking directly would be, and the importance of speed in conducting a raid, the selected landing sites are likely a strong approximation of the directions from which the kastra would be threatened (Pryor & Jeffries 190-191; Konstam & Dennis 32). Such ships lacked auxiliary craft.

Firing Positions

Range increments have been drawn in order to determine the 'reach' of each fortification, i.e. its ability to project threat without its occupants having to risk themselves on the field of battle or run down an enemy. Ranges were obtained using the buffer tool, and as a result do not take elevation into account, but provide a rough visualization of the reach of these fortresses. This analysis would be greatly aided by the use of proper military spatial analysis tools, which allow for calculations such as determining projectile range based on elevation and various ballistic factors. Such toolsets are proprietary and expensive, however. Regardless, the simplicity of creating range increments with buffering belies its effectiveness, because the elevated positions of the kastra mean that the range of projectiles would likely be longer than that indicated by the mapping, and so this technique serves as a low-end-of-average estimate.

The firing arcs taken from these weapon ranges all suffer from the drawback of being based on presumed tower locations. The difficulty lies in the fact that, while Kastelli has clear towers, Agios Konstantinos and Galatiani are much less clear on this count; the promontory bastions of the former and the northern gate and plateau bastions of the latter are likely spots for elevated firing positions, but other than that, guesswork is involved. While all three sites have walls too thick for them to be mere barriers, they are also (aside from the much thicker walls around the western gate of Agios Konstantinos) at the cusp of being wide enough to confidently assume a walkway. Kastelli's sea walls, the best preserved of its components, feature a parapet-walk that would be narrow but passable (fig. 7). Indeed, photographs from the early 20th century depict the crenellations of the sea walls clearly enough to definitively rule out that they are mere features of the walls' decay, thereby verifying that they were intended to serve as fighting platforms (fig. 8) (Gerola 59). With this in mind, the width of this wall will be measured,

and compared to the other fortifications. Walls of equal or greater thickness can safely be assumed to have had walkways, while those thinner are more in doubt.

Fig. 7. Kastelli's southern long wall with parapet-walk visible, taken in 1989 from the akropolis. Kardulias, P. Nick, August 1989.

Fig. 8. Kastelli's southern long wall, with crenellations visible. "Fig. 53 - Calamo - Castelo de Kasteli." Reproduced from "Monumenti Medievali delle Tredici Sporadi." by G. Gerola. *Annuario della regia Scuola Archeologica di Atene*, vol. 2, 1915, p. 59.

Galatiani and Agios Konstantinos, unlike Kastelli, both lack any preserved crenellations, let alone walkways. However, Koutellas' *Ta Byzantina Kastra Ths Kalymnou* reconstructs both

sites (as well as Kastelli) with walkways and crenellations, though he does not address the reason behind this choice (Koutellas, "Ta Kastra," 65-67). While photographs of Agios Konstantinos may show holes for timbers which would support a wooden walkway, all photographs of the walls lack sufficient resolution to determine if the holes are intentional, the result of collapse, or merely visual noise from the images themselves. Thus, this study will remain agnostic about assigning new firing positions to the kastra based on their walltops, since Galatiani and Agios Konstantinos are unclear, and Kastelli's plethora of towers means that the indicated fields of fire would not change by much.

Weapon Ranges

With firing positions established, range increments can be drawn outward from them, giving an indication of the defenders' reach when under attack.

The first range increment represents maximum range for accurate sling-shooting by a decently experienced user (Marsden 94). Slings were near-ubiquitous in the Mediterranean, and would have been highly effective at close range (Marsden 95). Slings represented a powerful weapon even against armor, and their ease of manufacture, as well as ability to use any appropriately sized stone as makeshift ammunition, represent a far more 'sustainable' weapon than the bow, in the context of a protracted engagement. The slinger's ideal equipment would of course be a durable, purpose-made sling, with premade sling bullets, either stone or metal, but they could make use of much rougher weapons and ammunition, which notably would not be nearly as durable or identifiable in the archaeological record. Combined with their far greater ease of production in comparison to bows, proficiency with slings was also quite commonplace,

as the Strategikon of Maurikios indicates that even the servants of a soldier on campaign would be proficient enough with slings to guard an army's fortified camp (Maurikios 71).

Bows were generally neglected weapons among Greek-speaking peoples, and later the Romans, until roughly the 4th-5th century AD, after which they became increasingly prized, coinciding with the rise in prominence of horse archers amongst Roman military ranks (Coulston 179). These bows tended to be powerful composite bows of horn construction, capable of firing some 300 meters with decent shot groupings from a highly trained archer (K.C. Randall 48). This distance has been taken as a long range, suitable for harassing targets, but unlikely to inflict massive casualties. It is also worth noting that Kalymnos, owing to its lack of forests, has very little game to hunt, so archers would almost by necessity have learned the skill for military purposes- this would, if subsistence were the only factor, result in very few men being proficient with a bow as opposed to a sling, which is more useful for hunting the various small fauna and vermin that live on Kalymnos. However, the Strategikon of Maurikios, written likely within a century of the construction of the kastra, stipulates that all Roman men under 40 should possess a bow and quiver, whereas foreigners are exempt (Maurikios 12). Without any archaeological evidence of bows on the island, and Newton's tantalizing mention of bronze arrowheads at Christos Tou Ierousalim having no further detail, it cannot be stated with certainty that such weapons were widespread (Newton 307). Given that the kastra were most likely built while Kalymnos was part of the Karabisianoi fleet, there is a possibility that such requirements would have been significantly relaxed, since it would not have provided soldiers, other than possibly marines or rowers. None of the evidence against the use of bows is conclusive, however, and so they will be treated as a key component of the kastra's defenses.

A special type of weapon, sadly lacking in details pertinent to mapping, is the solenarion, essentially an arrow-guide allowing Roman archers to fire short darts with their bows (Maurikios 197; Nishimura 422-525). Such darts supposedly had a much longer range and velocity than standard arrows, in addition to being far more economical in terms of volume and weight per unit of ammunition (Nishimura 429). However, their range is a somewhat open question, with some estimates going up to double that of a standard arrow, while somewhat criticized reproductions have resulted in more modest range improvements, and, on the other end of the spectrum, wind-tunnel tests have yielded estimates in excess of 500 meters (Nishimura 429). In general, if solenaria were employed, a 400-meter range increment would thus seem a fair approximation. For reasons outlined below, the 400-meter increment will serve a dual purpose.

Artillery is the third ranged weapon system of note, arriving (though perhaps not to Kalymnos) in the late Classical period, spreading during the Hellenistic, and becoming much more complex throughout the Roman period (Marsden 2, 54, 75, 176-178). Pre-medieval artillery can be broken down into two general groups of relevance to this discussion: stone-throwing artillery and bolt-throwing artillery, which, speaking very broadly, filled the roles of anti-materiel and anti-personnel weaponry, respectively (Marsden 96).

While the likelihood that the defense of Kalymnos warranted the construction of large stone-throwing artillery seems low, it is worth considering the presence of artillery in general, as the presence of such weaponry would have had a transformative effect on the island's fortification layout. The problem with such weapons lies in the ease of their detection, which tends toward both extremes of difficulty, depending on the component in question. Stone-throwing engines themselves were largely wooden, with few metal components, all of which are essentially useless for any other purpose save to be melted down, be they from a

trebuchet or mangonel. On the other hand, the ammunition (large stones) of such weapons preserves excellently. However, the easily-detected ammunition would lie in unexcavated sites, as slightly rounder stones amidst heaps of collapsed building rubble, hillside scree, and housing foundations, making it difficult to definitively rule against, but providing no evidence in favor of their presence.

Stone-throwing artillery is very unlikely to have been a significant feature on Kalymnos during the seventh century. Given the island's deforestation and peripheral nature, neither the long timbers nor the highly specialized military engineering knowledge needed to create such artillery would likely have been present on Kalymnos. Finally, owing to their size and general use as offensive siege weapons rather than defensive ones, they can be safely discounted as having been a significant consideration in the planning of the island's defensive works (Stouraitis 375-376).

Bolt-throwing machines were accurate long-range anti-personnel weapons, and featured in Roman military arsenals until at least the 10th century, if not later, seemingly never being fully supplanted by trebuchets or mangonels, but rather by western crossbows in the 11th century (Dennis 106; Stouraitis 373). Such artillery is far better suited to Kalymnos' kastra, for many reasons. First, the engines were significantly smaller than stone-throwers, and thus could have been mounted in the relatively small towers, and on ramparts. Second, given the likely small numbers of combatants on each side, accurate and deadly bolt-throwers would remain extremely useful, due to their power, range, and accuracy. By comparison, stone-throwers required larger multi-person crews which would mean fewer archers or slingers defending the walls, fired in higher arcs and thus were less precise, and generally had a much shorter range. The only significant benefit of stone-throwers would be their potential to seriously damage enemy ships or

threaten to do so, potentially delaying or entirely averting a raid. While this would be a valuable tactical advantage, it is worth considering that bows had generally longer ranges than stone-throwing artillery (Dennis 107). Given that bow ranges do not extend significantly past the shore at any site except Kastelli, there is little to no chance that defenders would have been able to target enemy ships with stone-throwing artillery at Galatiani or Agios Konstantinos, both of which have far more potential firing positions for such large engines.

Thus, for the Roman fortifications, an additional range increment has been included, as an indication of the range of bolt-throwing artillery, and stone-throwing artillery has been discounted as a possibility. This range increment extends out to approximately 500 meters, with some variance based on height being estimated due to the lack of access to ESRI's official military toolset. This range represents roughly the maximum range of Roman bolt-throwers, whereas accurate aiming range would fall somewhere within the previously established maximum bowshot range, likely in the neighborhood of 200 to 300 meters (Rossi 76-81). However, it is worth noting that ancient bolt and stone-throwers potentially were mechanically accurate out to their maximum ranges, so larger targets, such as ships or concentrated groups of men, would likely still face a significant threat at the maximum range increment (Marsden 94).

The small size of Hellenistic fortifications make it somewhat doubtful that artillery were being employed in these locations, as artillery of the time was most often used in sieges, and neither Kastri nor Kastellas seem built to withstand long-term sieges, judging by their lack of identifiable cisterns. While the cities of the time may have warranted the presence of artillery, considering that the Hellenistic poleis of other islands such as Chios and Samos demanded young men practice the use of artillery, the lack of preserved towers makes identifying firing arcs virtually impossible (Marsden 54). For the sake of completeness, shorter-ranged artillery

increments of 400 meters maximum, commensurate with the ranges of early artillery pieces, have been added to Kastri, due to its identifiable towers (Marsden 86)**.**

Roman fortifications, however, all seem more fit for the use of bolt-throwing artillery, featuring numerous bastions, possible crenellations, and (at Kastelli) towers, and thus artillery firing increments have been added to all of the Roman fortifications. This is not to indicate that these weapons were necessarily in common use, but simply that the fortifications were suitable for their deployment. Due to the complicated and obscure history of torsion artillery after antiquity, the same increment of 400 meters as used at Kastri was applied to the three seventh-century kastra as well, serving as a highly plausible baseline, with the acknowledgement of the potential for longer ranges as well.

As for stone-throwing artillery, Roman armies had been using traction trebuchets for potentially up to a century before the kastra were built (Dennis 104). This is a considerable amount of time for their proliferation, and thus, while the kastra may not have been clearly designed with them in mind, stone-throwers could have been a feature of the defense at various times. However, if they were, it is unclear what military advantage they would offer in comparison to giving the entire artillery crew bows or slings, or even large rocks to drop by hand from the ramparts. With this in mind, they have not been added to the map.

Chapter 4: Results

Examination of the several lines of investigation outlined above provided valuable insights on the nature of the kastra. Below are listed the results of the investigations that produced information with measurable qualities. These include efforts to determine material sourcing, examinations of terrain and movement cost, and attempts to locate firing positions.

Material Sourcing

Unfortunately, no writings suggest anyone has previously searched for the sources of stone used in Kalymnos' Roman kastra. There are only two fortifications for which clear and likely sources of stone exist, and both are Hellenistic. The first is Damos' akropolis wall, which, according to Newton, is practically on top of its quarry (Newton 301). This quarry has been confirmed by photographic evidence taken by P. Nick Kardulias in the 1980s, though the site is currently obscured from the air by heavy foliage. The second such site is Kastri, because the regular right angles formed between the internal ground level and the shelves leading up to cliff faces surrounding it suggest the removal of blocks. Moreover, the combination of the fortification wall and the cliff walls' matching stone, as well as the sharp incline up to Kastri, suggest that the blocks are from within the site, and that bringing such huge stones from elsewhere would be a monumental task to enclose such a small area. Sadly, other than Kastri and the Damos Akropolis, the other sources will remain a mystery, as no other quarries were located.

However, the presence of sizeable scree slopes at Galatiani and Agios Konstantinos may present sources for stones that were then only slightly altered by local masons. In order to test this possibility, an area of the Agios Konstantinos gully lying within the walls and exhibiting large amounts of loose stone was measured. The total area of this scatter is approximately 1,649

square meters. Owing to the incredible mathematical complexity and randomness involved in the way scree slopes form, no comprehensive breakdowns of the composition of such formations was available, and thus the following calculations will rely heavily on conservative estimates based on personal experience with the island's geology (Kirby & Statham 359-362). The following calculation will assume that 50% of stones in a scree slope are usable (probably a low estimate given the roughness of the walls), and that the average building stone is around 30 cubic centimeters, with scarce but valuable larger stones and common but mostly-filler smaller stones both being conflated into that average. Again being conservative, the scree will be assumed at a depth of one such average stone.

With the above figures in mind, the scree slope in question would hold a total of 2,748 usable stones, for a total volume of approximately 74.2 cubic meters of building material. Assuming the walls rose to approximately 2.5 meters, and are within Koutellas' stated range of 1-1.5 meters thick including mortar, a mere 80-meter stretch of streambed could supply enough stone to complete 30 meters of defensive wall purely built of stone, and likely far more once mortar was added. The unusable pieces of stone would also be a source of limestone powder for use in mortar. If all of Agios Konstantinos' area supplied rubble, even taking only 5% of the theoretical 'rocks' (the 30cm square units) within the walls rather than the 50% from the streambed would result in 18,564 stones, enough for 501 cubic meters of building material, or 200 meters of mortarless wall. Considering the northern wall of Agios Konstantinos is only about 270 meters long, combined with the prevalence of other scree slopes and the likely far higher percentage of usable rocks, it seems safe to assume that Agios Konstantinos' walls could easily have been built entirely from rubble. It is also noteworthy that these calculations omitted

the areas outside the walls; such a distinction would have been immaterial before the walls had been constructed, which is the purpose of these calculations in the first place.

Terrain

All landing areas other than Masouri and West Telendos were identified as possessing the correct gradient for amphibious landing. However, having personally visited the shore at Kantouni, it is an extremely easy place to land, and the DEM is somewhat inaccurate in this area. Additionally, despite the two lines of evidence implying that West Telendos' landing site was impractical, these indications run up against the fact that Agios Konstantinos features a western defensive installation directly facing this landing site, with perhaps two layers of defense, extremely broad walls, and significant bastions. The final issue arose in that there were multiple indications that the shoulders of the Kastelli peninsula may be suitable landing sites. However, not only would these locations be quite easily within bowshot, and within the close range interval of the southern wall, but images from dive tours around the peninsula indicate that much of the peninsula is nearly a sheer cliff under the water, and that the boolean's interpretation of gentle slopes on the shoulders is much more a result of its low resolution than the actual nature of the land, as images show two to three-meter rock faces above the water. This served as a strong cautionary tale on the extent to which one can trust a DEM on an island made of rocks (fig. 9).

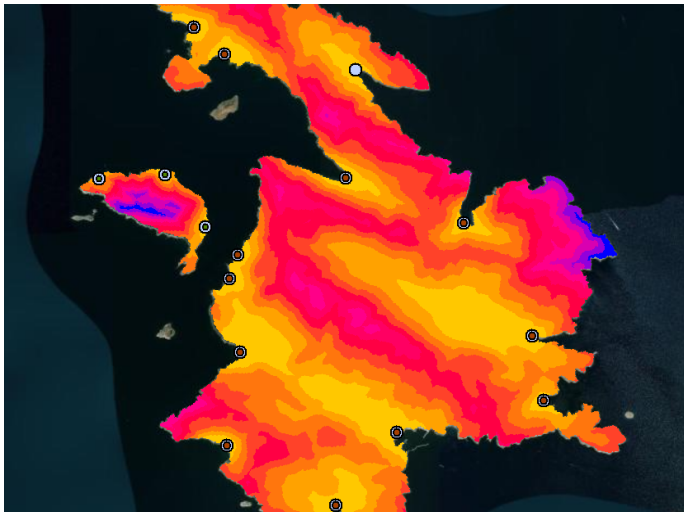


Fig. 9. Map of travel cost from various landing points. Note how rapidly the cost increases outside the small valleys. Map of Kalymnos, Greece from: "Kalymnos, Greece" Map, *Google Maps*.

Firing Positions: Towers and Walltops

The identification of towers was complicated by their rarity. Still, potential bastions were located at each site, and towers at Kastelli as well. The identification of Kastelli's akropolis towers was likely overzealous, as on-the-ground photos show at least one of the identified structures to be one of the kastro's cisterns, and several are likely houses as well; identification of the lower bailey's towers was entirely in line with the conclusions of Koutellas ("Ta Kastra" 433). However, this part of the identification process was primarily about finding firing positions, towers simply being the most obvious manifestation. Thus, taking into account the structures were likely flat roofed, and the cistern retains part of its vaulted ceiling, as well as the height of the akropolis and the uncertain height of the upper walls, it is entirely possible that such structures could still have served as secondary firing positions. The nearby tower would naturally be the most advantageous and offer the best cover to defenders, but there would be no reason to pass up the elevated position of the inner rooftops unless the wall rose higher and blocked them from line of sight, which would require deeper investigation to determine. With all this in mind,

the falsely identified towers of Kastelli will still be considered firing positions, along with the correctly identified ones.

As for bastions, there is a possibility that the two northern wall projections at Galatiani are merely areas where the wall has slumped outward, giving it the appearance of protruding from above. However, the height of the wall in this area is unknown, so it is impossible to determine at present whether it even has sufficient height for this to occur, let alone whether its construction would allow this rather than causing it to simply break apart. The walls of Agios Konstantinos seem to have broken down into scree rather than bend, so the lack of obvious debris makes the identification as bastions more plausible.

Attempting to identify ramparted walls was difficult. Due to several factors interfering with the accuracy of measuring wall thickness, the results will be treated as a range, and checked against the metrics provided by Koutellas. As stated in chapter 3, ramparts will be assumed for walls around the thickness of Kastelli's sea wall, and put into doubt if any thinner. Where conflict exists between the author's measurements and those of in-person observers, the in-person observations will take precedence due to the above-mentioned difficulties in measurement.

Distance measurements were taken first at the sea-wall of Kastelli, one in the middle of its course, one near where it joins the lower bailey, and one near the sea. The three measurements all fall in the range of 1.5-2 meters. Unfortunately, no in-person measurements of the walls' thickness exist for comparison. Galatiani's single continuous wall varied quite widely in its thickness, from over 2m near the southern gate, to well under a meter on the western cliff face, 0.6m and 0.8m south and north respectively, and thickening again to 1.4-1.8m in the area of the northern gate. These measurements roughly agree with Koutellas' in-person measurements of

1.6-2 meters thickness (Koutellas, “Ta Kastra,” 65). Finally, Agios Konstantinos’ walls proved quite thick; measuring at five points from east to west, the main wall was 1.5m thick at the promontory (where it mostly served to reinforce the slope), 1.8m thick a short way east of the gate, 1.9m thick a short way west of the gate, 1.7m thick at the area where the concavity ends and the wall runs straighter, and 1.8m thick near the end of its course. However, Koutellas reports the walls averaging a thickness of 1 to 1.5 meters, making these results highly suspect (Koutellas, “Ta Kastra,” 67).

Chapter 5: Discussion

This chapter will first move through several lines of analysis, drawing conclusions as to what they reveal about the kastra. These topics are the sources of material, the presence/absence of ramparts, the anomalous case of Hellenistic Kastellas as a point of contrast to the Roman kastra, trends in the shape of walls, an examination of how flanking is facilitated in each of the kastra, and finally the intervisibility of the three sites. After examination of these topics, I address the degree to which I can answer the research questions posed at the outset of the present study.

Material Sources

The lack of likely quarries besides Kastri and potentially the Damos akropolis has provided very little basis for determining the manner in which material was sourced and utilized in the construction of the kastra. Even beyond the gulf of roughly a millennium separating Kastri and Damos from the Roman kastra, the combination of the Hellenistic sites' very small surviving walls, tiny enclosed area, and highly porous surrounding rock makes them only very rough analogies for the later kastra. Moreover, the masonry of the Hellenistic fortifications involves very large and regular blocks, which are likely more difficult (but also more worthwhile) to transport than the smaller, irregular stones of the Roman kastra. Thus, attempting to use Kastri and Damos for comparison was already somewhat dubious, and, in the end, did not provide enough guidance to produce results.

Unfortunately, despite being the only sites with likely quarries nearby, Kastri and Damos are almost certainly not the source of the stone used in other fortifications, or at least cannot be confirmed as such, for several reasons. The most noteworthy reason is that neither site has

produced any evidence of occupation after the Hellenistic period, and certainly not into late antiquity or beyond. Though a quarry could be a site purely for extraction, it would be strange to see work carried out in defensible and formerly inhabited places without anyone making any detectable use of them, considering they would have been there for long periods of time. As for Kastri, though it benefits from being relatively near a port, considering the greater ease of moving such heavy material on a circuitous and hilly land route, the steep slope of the hill leading up to the fortress would have been a death trap for any involved in carrying heavy things downward, and likely impossible for beasts of burden to make the journey upward if carrying significantly more than what a person could carry. Moreover, while it is possible and even likely that many traces of the quarrying have vanished due to weathering and collapse over the centuries, the sheer quantity of stone required for the three kastra could not have been extracted from Kastri or Damos without leaving traces that would be much more significant than those present today. Damos faces this difficulty less, due to having a much more verifiable and significant source of stone, and the location of its quarry on flatter ground makes it a more tempting location. However, its position well inland in the southern valley and its distance from seventh-century population centers makes it an unlikely candidate.

The failure to source the material may be a result of the quarries being functionally undetectable. There are three possible explanations: that the sites are now gone, that the sites are hidden, or that little to no quarrying was involved. Some blend of these three ideas may also be possible. Notably, these explanations, while some have limited applicability to other periods, only intend to cover the seventh-century Roman kastra, since the obstacles and distances between them and the fortifications from other periods mean that they would have a vanishingly

small likelihood of sharing the same source of stone (again, assuming the stone was Kalymnian and not shipped in).

The first possibility, that the source or sources are now gone, has several different permutations, all of which fall under the umbrella of erosion. Kalymnos' limestone geology has produced several sinkholes on the northern coast which appear full of loose stone, and several of the areas of coastal cliff are eroding into the sea, some in large chunks. Moreover, the mountains are constantly creating vast scree slopes, which could easily bury a quarry. The sinkholes' remoteness from the inhabited areas and kastra is less of an issue due to the only access being by ship--thus, anyone arriving there would have the means of transporting material already with them. Still, the sinkhole possibility seems remote, as the only possible motivation would be that, owing to Kalymnos' geology, harder rock layers can be found down below, and thus the sinkholes have the potential to grant access to superior material. Their use strains the economic logic of the builders, and thus does not warrant much consideration. Much more likely is that the erosion of coastal areas may have destroyed the quarry/ies. Since stone would be most easily transported by ship, coastal quarries would be the most efficient, since they remove the entire first leg of the process by having the ship adjacent to the production area. Moreover, coastal cliffs would be an ideal location for a quarry considering they feature exposed stone, and often deeper water, allowing ships to anchor closer to shore. Considering the coastal cliffs on the north side of the Telendos bay seem to be the most rapidly-eroding part of the island, falling off in huge iceberg-like chunks; this possibility would both be the most destructive of the site/s, while also being the second most reasonable in terms of proximity and transportation for Agios Konstantinos and Kastelli. The only potential shortcoming of this proposal is the fact that, if the quarry was dug in a stepped manner, it likely would have endured much better than the

surrounding cliffs; however, the sheer volume of rock in motion around it, as well as the lack of certainty as to what method would have been employed, still suggests the possibility of the quarry being destroyed in such a way. While the most logically sound solution, coastal erosion is very difficult to falsify or verify short of chemically determining the origin of the wallstones, since any site destroyed in such a manner would be effectively wiped from the archaeological record entirely.

The second possibility, that the quarries are now hidden, has three permutations. First is that the quarries have been covered over by modern settlement. There are many inclines on Kalymnos, and, considering many people currently use bulldozers to cut into cliffsides for house foundations, it would make a great deal of sense for (especially preindustrial) Kalymnians to utilize an already-existing cut into a hillside. Of course, this would mostly apply to very old structures, since modern builders would likely face legal trouble for building on an ancient site, if it were recognized as such. Given the island's small population outside the southern valley, essentially being a string of hamlets on the west coast/Telendos bay where the kastra are clustered, this seems unlikely. The second permutation of this possibility, though unlikely, is that the island's current massive quarry in the southern mountains has been used for a very long time; due to the difficulty of transport to the seventh-century kastra, requiring travel over many hills (and mountains and sea for Galatiani and Agios Konstantinos, respectively), this seems much more unlikely than the first. Notably, this difficulty would be substantially lessened for the two kastra of the southern valley. While still difficult, if the material was deemed superior, laborious transportation may have been judged worthwhile. The final possibility is that the quarry could simply be buried or covered by plants. A divet in a hillside is exactly the type of thing that is easily buried, and the mountains of Kalymnos are constantly producing vast scree slopes which

could easily bury a premodern quarry, especially considering such a quarry would benefit most from being near steep terrain. As for vegetation, a stone-bottomed quarry is a likely place for water to accumulate, and thus plants will tend to grow thickly around such a site. In the Cypriot town of Athienou, early 20th century looters considered particularly large and green thorn bushes to be the best sign of a buried tomb, since the artificial aquifer-like cavity of dirt in the stone retained water, and would grant the plant a huge advantage over others; a similar principle applies here (Michael Toumazou, personal communication). Occlusion by dirt, rock, or plants is one of the most plausible explanations across most of Kalymnos, but is uniquely frustrating for this study. Without a high-resolution pedestrian survey of the island, there is little utility in trying to determine relative bush-cluster density or scree slope length, since there are easily thousands of both on Kalymnos, and so many confounding variables exist influencing the morphology of both that any observation from satellite imagery is essentially useless. Still, burial is among the strongest possibilities.

The final possibility, that there was little to no quarrying, has two distinct permutations. It is possible that the kastra used primarily spolia, and used the material so heavily that the original structures they took from are either not visible today, or their level of disrepair is indistinguishable (without purposeful examination) from that of structures that were either not recycled, or recycled with less purpose and direction. While it is possible that such material could be shipped from where it may have been plentiful, e.g. the western shore of Telendos, such an effort would defeat the entire purpose of using spolia, which is the relative efficiency compared to cutting and transporting new building material, since transporting two things equal distances will always be much more worthwhile for the purpose-made material rather than that which is being repurposed. Put simply, a three-stage transportation process for stones that may

not even fit the planned design would hardly be more efficient than cutting stone near the source, and shaping it to purpose. Moreover, the very rough construction of the walls of Agios Konstantinos and Galatiani, if they were the product of repurposing old building material, would scarcely seem worth the effort. These walls are unlikely to merely be the remnant of a rubble core given their use of mortar, and thus they are highly unlikely to ever have had a facing of finer stone. The final possibility, which offers the easiest transportation of all, is that the builders may simply have utilized local scree and ground stones, modifying them slightly, if at all. This solution almost entirely removes the issue of transportation, for Agios Konstantinos especially, and fits well with the relatively rough appearance of the surviving walls of the seventh-century kastra. The sheer convenience of this method for the inhabitants, taking into account that the construction was likely locally motivated, makes it a very strong possibility. Agios Konstantinos especially would be the perfect location for using such material, since the concave mountain face produces a massive rock pile that rolls part of the way down to the wall of its own accord. As mentioned in the previous chapter, even with extremely conservative estimates limited only to the area within the walls, the northern wall would be almost entirely buildable from loose rubble. However, for Galatiani and Kastelli, the use of scree is less certain. Galatiani is on rocky ground, but it lacks the prodigious scree slopes of Agios Konstantinos, at best having a small crumbling ridge. Still, given the difficulty of moving material up the steep paths to the mountaintop, combined with the relatively much smaller volume of wall constructed, local rocks may have proven sufficient; without the ability to know how high the walls once were, or more detail as to the number of structures within, the question remains very open. Kastelli, on the other hand, has several scree slopes, none of which are tremendous, but in total appear to have a good quantity of loose material. The difficulty with Kastelli is that the total volume of wall in the kastro is

immense, with a wall each for the lower bailey and the akropolis, two outer stretches of wall, one heading southward to the sea, the other heading north, and multiple towers, as well as vast cisterns. Adding in the structures inside, it beggars belief that Kastelli could be constructed solely from scree and ground stones. Moreover, the proximity of Kastelli to the sea, combined with its less rugged landscape than the other two, mean that it would have been the easiest of the sites to which to transport stone from elsewhere. Finally, various assessments of Kastelli's masonry describe it as superior, and photographic evidence seems to bear this out.

To summarize, the sources of the material used in the Roman kastra may have been missed for a variety of reasons, but ruling out user error, it seems likeliest that Agios Konstantinos was constructed largely from scavenging local rockfalls and modifying the recovered stones, and that Kastelli was (at least in large part) built with stone scavenged elsewhere, or mined in a quarry that is no longer identifiable as such. Galatiani is less clear than the other two, but the use of local surface stones seems a bit more likely.

Ramparts

Attempts to measure the width of the walls at the three kastra were severely limited by three factors. First, the mechanical accuracy of the user, as this relied heavily on eyeballing when the cursor had been placed exactly correctly, and the image of the walls, even at maximum zoom, is very narrow on a monitor. Second, the visual quality of the basemap, which was low enough to make picking out the exact starting point of walls difficult, especially at Agios Konstantinos, where the expanses of rubble adjoining the walls make determining their exact endpoint a difficult process. Finally, the angle of the imagery was a significant challenge, as none of the kastra walls were viewed from a directly top-down perspective, and thus the previous two

problems were compounded by the difficulty of attempting to distinguish the top of a wall from its side. Galatiani's walls seemed to be the least affected by the angle of the image, possibly because of their severely reduced state.

Still, measurements were not entirely outside the ballpark of what is reported by Koutellas. From these measurements, a few conclusions can be drawn. With specific measurements of Galatiani's walls at different points, and with comparison to Kastelli's known ramparted wall, it can be deduced that the northern and southern gates of Galatiani could have been flanked by ramparted walls, whereas the cliffside, western portion of its wall may have been too thin to support them. If so, this makes a good deal of sense, as few enemies would be willing to risk the almost-sheer climb up the west slope of Galatiani. At Agios Konstantinos, on the other hand, despite the measurements of this study being very similar across the course of the main wall, Koutellas reported much thinner measurements, in the range of 1.0-1.5m (Koutellas, "Ta Kastra," 67). Though the upper range likely would have supported a rampart, the lower range falls well below that of Kastelli's sea wall, thus complicating the question. Though the concave firing position around the gate of Agios Konstantinos would be utterly wasted without some form of firing positions, it is possible that, if ramparts were not in place, defenders may have taken up position slightly further uphill, granting a slightly less advantageous angle of fire, but saving considerable labor in the creation of the walls. There also remains the possibility of wooden platforms, either directly mounted on the wall with beams installed into its structure (if the holes existed), or simple scaffoldings erected behind it. Both of these solutions require closer examination of the sites, and, due to the low height of its remaining walls,, the first possibility may be impossible to test at Galatiani. To find post-holes for fighting platforms, some form of

excavation would need to be conducted, with the hope that the soil of the steep slope has not been too churned in the intervening millennium for such traces to be found.

Problematic Cases and Strange Routes

While the Roman kastra are the focus of this study, their predecessor fortifications exhibit several confusing traits. While the tendency to expose the enemy's shielded flank and to prefer straight walls over topographically efficient ones has been stated before, another significant discontinuity with the kastra was the pre-Roman tendency to create fortifications as counterparts to permanent settlements, in arrangements that appear rather inefficient. This topic serves to illustrate that, despite their inferior stonework, the kastra were far more tactically sound fortifications than their pre-Roman counterparts.

The case of Kastellas is an interesting one, as the fortress, seemingly put in place to overlook the town of Embolas, is quite superfluous due to its positioning. The easiest avenues of attack against Embolas would quite clearly be from the bay of Vathy (1), from Pezonda Bay (2) to the north, or over the mountains and into the valley of Vathy from the south, landing at Akti Bay (3). Immediately, it is apparent that Kastellas is in a bit of a conundrum: viewshed shows that it could see only one of these avenues of attack any better than could Embolas, that being the southern route into Vathy around the mountains on the east coast, while cost path analyses show that that southern route, from which it is on the other side of Embolas, is the second most efficient route, and the northern route from Pezonda goes almost entirely out of the way of the fortress. With the fortress neither particularly more capable of blocking or viewing avenues of attack, its purpose is hard to determine.

Moreover, images (figs. 11, 12) show far superior construction and height of the walls at Embolas, seemingly making Kastellas obsolete. The question of why Kastellas was even built, considering the fortifications seem to have been constructed at roughly the same time, is a pressing one, as it is too far from the town to serve as an akropolis in any but the military sense, and the only land it controls more directly than Embolas is unfarmable mountainside.

Kastri, on the other hand, is quite clear in its purpose. The fortress stands atop a crag in the mountainside north of the village of Emborio, which seems to have been a port for as long as the island was a worthwhile trade partner (Bean & Cook, 129). Yet, in spite of its clear purpose, the efficacy of Kastri is somewhat questionable. The fortress is small, and, while it offers a better view than the coastline at cove-bound Emborio, it is still nestled into a cliff face which severely restricts the field of view. Even with forewarning of an incoming threat, the inhabitants of Emborio would be hard pressed to make the steep climb up a gully in time, which only features steps at the very top of the approach. The site would be almost unassailable if properly blocked off, but the tiny space and lack of cisterns would have made it entirely unfit to withstand a siege. With this in mind, it is unsurprising that, while Emborio carries on as a port throughout history, the Roman Kalymnians made no use of Kastri (Heslop 39).

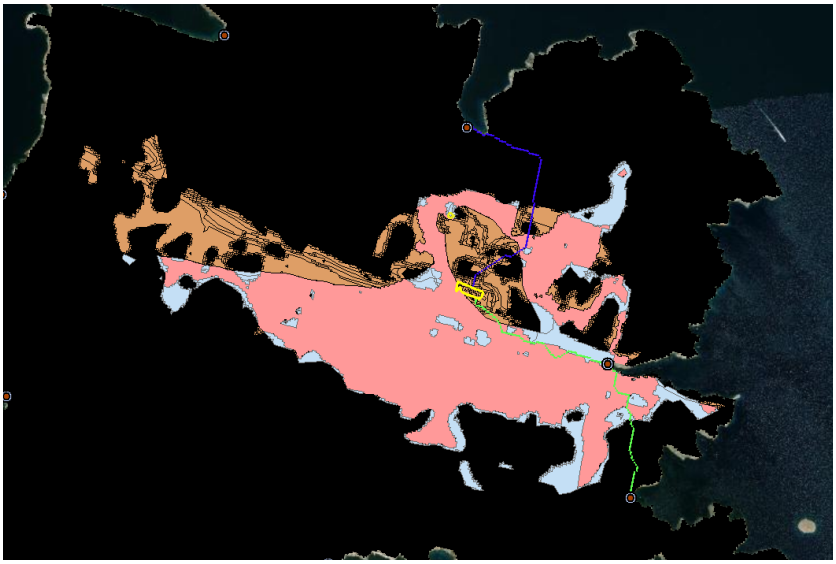


Fig. 10. Views from Embolas and Kastellas, with least-coth paths included from Akti (blue) and Pezonda (North). Coral represents areas that are visible from both locations, while blue represents areas visible only to Kastellas, and orange represents areas visible only to Embolas. Map of Kalymnos, Greece from: "Kalymnos, Greece" Map, *Google Earth.*

Figs. 11 & 12. The wall construction of Embolas (Fig. 11, left), though roughly contemporary to Kastellas (Fig. 12, right), is clearly superior. Reproduced from "The Carian Coast III," by G.E. Bean and J.M. Cook, 1957, *The Annual of the British School at Athens*, *52*, plate 26.

Though there is no evidence for Kastelli being older than the seventh century, the association of the site as the Palaiokastro of the Gorgon suggests some have assigned it a greater age. This can be simply refuted through multiple lines of evidence, but among the most compelling is travel cost (fig. 13). Considering that the only relevant settlements near Kastelli were Damos and Pothaia, if Kastelli existed at the time of the two towns, one would expect it to be easily accessible to act as a refuge, much like Kastri or Kastellas. However, foot travel from

Damos today takes some 80 minutes, even with modern roads, and the cost map clearly shows that the cost of travel to Kastelli, owing to the rugged coastal terrain, is comparable, in some places, to climbing part of a mountain. Thus, Kastelli would have been supremely useless as anything except a settlement, because no settlement was situated to benefit from the protection of its walls.

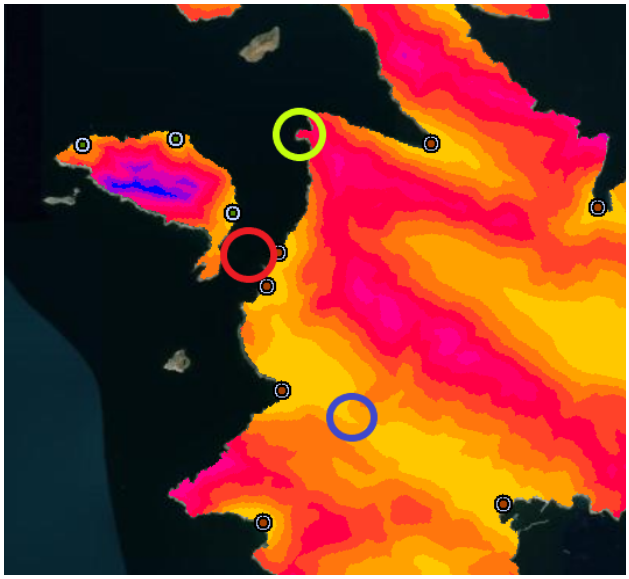


Fig. 13. Travel cost layer, depicting Kastelli as similarly inaccessible to a mountain slope, even from nearby landings at Arginonta, and at Masouri, roughly in the region of where Pothaia would have stood. Kastelli is circled in yellow, Pothaia in red, and Damos in blue. Map of Kalymnos, Greece from: "Kalymnos, Greece" Map, *Google Earth.*

Wall Shape

The Roman kastra of Kalymnos have almost no straight-line walls for any significant distance, the only example being the southern exterior wall of Kastelli which runs down to the sea. This represents a marked departure from the Hellenistic fortifications of the island. While Kastellas notably is quite rounded and irregular in its form, Embolas, Damos, and Kastri all feature fortification walls that are remarkably straight given the terrain, sometimes to their detriment. Damos' straight-line akropolis wall is the most logical, given that the ridge on which it stands is roughly flat, and the goal of the wall is merely to close off the one side from which

the raised tongue of land can be accessed. Less reasonably, Embolas' walls, though atop a short cliff alternating with hillside, which grants them an excellent vantage over most of the Vathy valley, continue in a straight course rather than following the contours of the ridge, often standing slightly back from it. While potentially more stable, this would make the walls far worse as firing positions, since, at many points, the contour of the cliff, one or two meters in front of them, would provide enemies with cover directly adjacent to the wall, negating the advantage of the extra height granted by the terrain. Parts of Embolas' wall do follow the contours of the land, especially toward the west portion and on the very eastern end, which make the straight sections in the east all the more baffling, as they essentially grant enemies cover, while offering no significant benefit to the defenders in return. The most baffling of the three, by far, is Kastri, where the main flaw of its straight wall is plainly evident today: it currently bows outward under the weight of the ground within, somewhat like a dam bursting at a glacial pace. The uneven level of the original cliff shelf is evident from below the wall, which rises to exactly the internal ground level, but externally is almost V-shaped due to how deeply the cliff face dips. Considering the sheer cliff atop which it stands, and the ample coverage provided by the two towers at either side of the shelf's mouth, it scarcely seems necessary to utilize such fine and labor-intensive masonry when the primary goal of the wall seems to be essentially that of a fancy terrace wall, maintaining the artificial ground level inside. If the wall were made of smaller stones and allowed to be somewhat concave, it would not only be much more efficient in terms of labor, but likely much more stable as well, and follow the contours of the land much more naturally.

By contrast, the walls of the Roman kastra, though visually less impressive due to their less precise masonry, are far more efficient in their positioning. Galatiani is an excellent

example, especially in comparison to Embolas. While Embolas' walls occasionally turn their strong position atop a short cliff into a weakness by being far back enough that the cliff could provide cover to the enemy, Galatiani's short southern ridge and western cliff edge are perfectly exploited by its undulating wall, which stands almost precisely atop the edge of both formations for as long as they persist, even on the west wall, which arguably would have been far easier to build on the gentler inclines higher up the slope.

Right Flank Exploitation

Aegean cultures have long acknowledged that attacks to the right flank are more effective than those targeting the left flank, due to the near-universal use of shields since at least the Bronze Age; thus, it is somewhat surprising that Kalymnian fortifications from before the Roman period seem unconcerned with this basic principle of ancient warfare (Coulston, 169). Turning first to Kastellas, it is interesting to note that, if the perimeter has been correctly identified, it is the only large fortification on Kalymnos that seemingly does not provide its occupants with any sort of flanking position on attackers. Kastri, on the other hand, provides an extremely deep flanking position, with roughly a 15 meter steep ascent up a staircase carved between a tower and a cliff face, and yet the attackers would only be forced to expose their left sides, making this a far less advantageous position. Similarly, Damos' akropolis wall features a tower that would have been on the left flank of the likeliest location of the gate (Newton 302). This shared trait, seen in no other period, is hard to understand, given that shields were likely no less widespread before the Roman period than during or immediately after it. Embolas' lack of an identifiable gate excludes it from the discussion. However, even half of the fortifications taking left-flank

positions is an oddity nonetheless, given the prevalence of shields, and great difference in the Roman kastra.

By contrast, all four Roman kastra feature examples of exploiting the right flank of an attacking force. Kastelli amply exhibits this tactic, as the outer gate features a projection to the right of the entrance allowing fire down on approaching foes. Furthermore, the path to the akropolis requires attackers to expose their right sides to the defends atop the rock, surmounted by a series of densely-packed towers, and the stairway on the cliffside features a switchback halfway up, which results in an attacker's right side being exposed to a tower for the final portion of the ascent. In combination, these defensive features mean that any force attacking Kasteli would make almost the entire journey, from outside the outer gate to the inside of the akropolis, with their right flank exposed to enemy missiles (fig. 14).

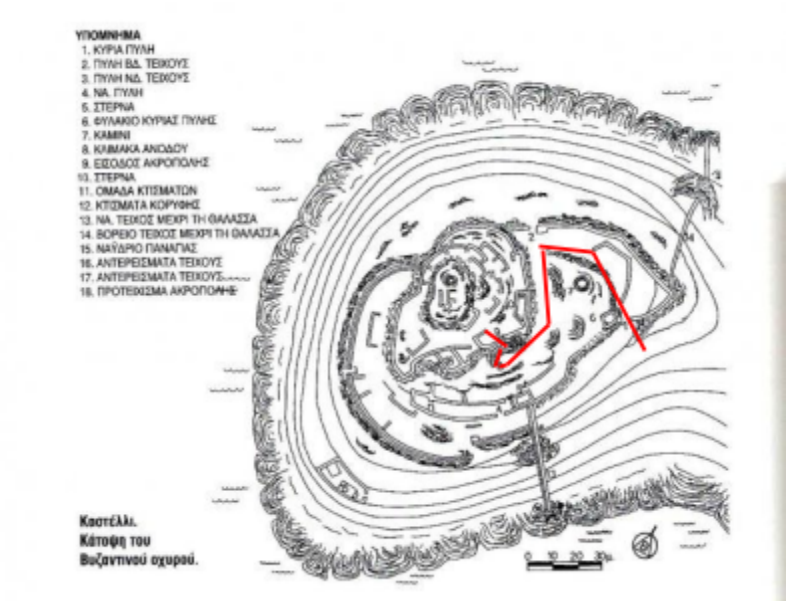


Fig. 14. Koutellas' plan of Kastelli, with author's addition of a red line marking the likeliest route of attack. Adapted from "Ta Byzantina Kastra ths Kalymnou," by M. Koutellas, 2005, *Kalymniaka Chronika*, *34*, p. 433.

Kastelli also, uniquely among the other fortresses of the island, is capable of completely cutting off one of the island's transportation routes. Were Kastelli to be equipped with bolt-throwing artillery pieces in its towers, their range would reach from the kastro to the inland

mountainside opposite it, rendering the entire coastal road unsafe for enemy movement, and cutting off by far the most viable land route to Emborio and Galatiani from the favorable landings of the southern valley. This potentially gives Kastelli the role of firebase, and lends additional protection to Galatiani, as the easier southern approach would then only be accessible via the much steeper ascent from the valley of Vathy (fig. 15). The other routes to Galatiani's southern approach involve landing at Emborio or Arginonda, which are not only easily visible routes from Galatiani itself, but would require sailing past either Kasteli or Agios Konstantinos, thus sacrificing the element of surprise, and potentially making attackers vulnerable to artillery from Kastelli, if it had any. Even today, cutting off the coastal artery would deny almost all traffic from the west coast to the rest of the island, save for by ship. According to Bean and Cook, writing in 1957, travel around the straits of Telendos was done by ship even during their time, meaning deeper in history it was likely near-totally seafaring, and thus the naval protection of Kastelli and Agios Konstantinos may be the more significant factor (Bean and Cook 128).

Fig. 15. Kastelli castle with short, long, and artillery ranges indicated, showing that artillery fire could create a beaten zone of several hundred meters along the coastal road. Map of Church of Kastro Kastelliou, Kalymnos from: "Kalymnos, Greece" Map, *Google Earth.*

While Kastelli certainly features the greatest number of instances of capitalizing on right-flank weakness, the other sites maintain the trend nonetheless. Agios Konstantinos,

seemingly featuring the fewest towers of any of the Roman sites, at only one in the main wall, nonetheless makes excellent use of flanking positions in its construction. The high promontory and extending lower rampart at the far east of the fortress would have provided excellent left-flank firing positions down into the gully which leads up to the gate. A high cliff also stands 150 meters to the right flank of the approach, which seems to bear at least some traces of defensive structures as well, permitting harassing fire. More accurate right-flank fire could be delivered as attackers came close to the gate, where the concavity of the surrounding walls would grant defenders a substantial height and flank advantage, at a range of a few dozen meters at most, while the enemy would be forced to advance in a narrow column up a gully too shallow to provide cover, but too steep to walk steadily on its sides (fig. 16). The gully likely has not changed much since the kastro's occupation, due to the combination of low rainfall and the various houses and the outer wall serving to break the flow of water. Thus, enemies approaching the gate would be funnelled and subjected to frontal enfilading fire, as well as high-angle flanking fire from both sides. Finally, since the path from the flat portion of Telendos (the east shore) to the gate of Agios Konstantinos travels east-west along the coast, the easternmost clifftop bastion would have provided a firing position from which an enemy attacking from an east shore landing would have exposed their right flank for a great distance, with a substantial height advantage to boot, albeit with occasional cover from the mountain slope. This firing position, combined with the roughness of the path, would have been a strong disincentive to land anywhere but directly below the kastro, thus sacrificing the potential element of surprise, and likely coming under bow fire before a vessel could make landfall. If the defenders of Agios Konstantinos were to employ artillery or solenaria, they could have targeted enemy vessels for nearly 100 meters before they made landfall. Targets pressed together in the confines of a ship,

some of which would have been rowers and thus defenseless, would have been an ideal target for such long-ranged weapons. The much more impressive western wall of Agios Konstantinos features two towers and a bastion at the higher southern part of the wall, all with an effective view of what appears to be the gate. The extremely broad wall at the extreme right (from the attacker's perspective) would have allowed the deployment of sizable artillery pieces or groups of defenders, and was likely built as a platform for just such a purpose, or else to bear some sort of defensive structure which has not survived.

Agios Konstantinos' main gate is also possibly defended by an extension of the eastern bastion, which is a small, narrow wall extending down the mountainside for a short distance. The extremely rocky terrain makes its contours difficult to discern, and its location, while it would be strange for a terrace wall, is equally strange considering the sharp drop from the bastion to where it stands. No ground-level imagery depicts this feature, it is ignored in schematic drawings, and it is absent from written sources. This silence would strongly imply it to be a terrace wall, but the strong flanking position it would provide makes such a conclusion difficult to draw.

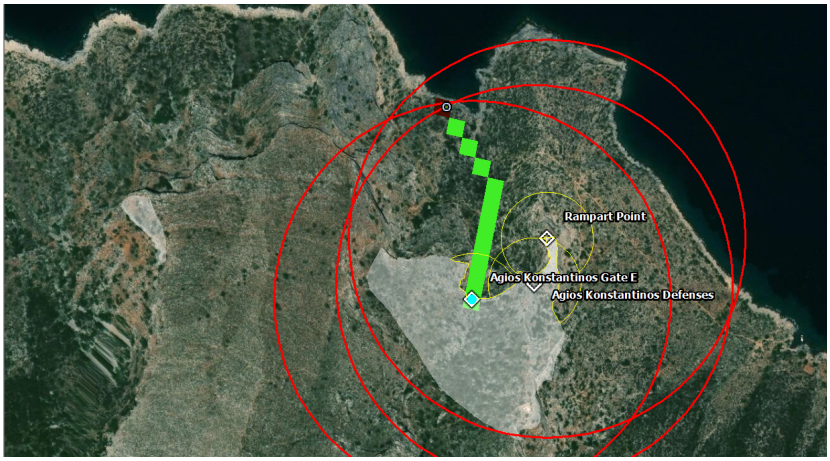


Fig. 16. Agios Konstantinos with least-cost path of assault (the gully) and bow and sling ranges noted. Note the concavity of the walls around the gate. Map of Church of Agios Konstantinos, Telendos from: "Kalymnos, Greece" Map, *Google Earth.*

Galatiani, meanwhile, features multiple wall projections, a high flanking cliff, and a lone rampart extension, but seemingly no towers. The identified location of its southern gate

Koutellas gives, right around the center of the southern wall, is a cliff face, which, in photographs, appears functionally impassable without climbing, let alone for any beast of burden or wheeled vehicle. Given that Koutellas' drawings appear to have been done without the aid of aerial imagery judging by certain distortions, it is possible his placement was merely off, and likelier that the current entrance to the kastro, on the southwestern corner, is the ancient one. The assumed southern gate is indented within the wall, with cliff face on the left and likely ramparted wall to the right, creating a long stretch of vulnerable path without any cover, exploiting the right flank and rear as attackers near the gate. Moreover, if it was intended to bear a rampart, the small projection of wall would stand to the left of this assumed gateway, thus granting the defenders a concave firing position on any attackers at the gate. The north portion of Galatiani's wall features a sharp drop to the right and a cliff to the left of the approach, and both a possible tower and a projecting bastion stand to the right of the gate, while the cliff on the left would provide an elevated firing position on the attackers left flank for at least the last 150 meters of the path, or more if the defenders were to move onto less even ground.

Finally, Chora Kastro features a long switchback ascent which exposes both sides to towers at various points. Notably, the final approach to the gate involves exposing first the right, and then the rear as well to a number of towers. At the main gate, this would result in overlapping fire from three directions, making any assault perilous. In fact, the only side which is not vulnerable on the final approach to the gate is the left side.

Though only featuring a single fortification entirely of its own siting, the Latin period shows a continuation of the same trend as shown in previous works. The castle of Chrysocheria is a strange one, with multiple entrances at different angles; however, the approaches to both the

main gate and the postern expose the right flank to a high rampart, and, in the case of the main gate, a sizeable tower as well.

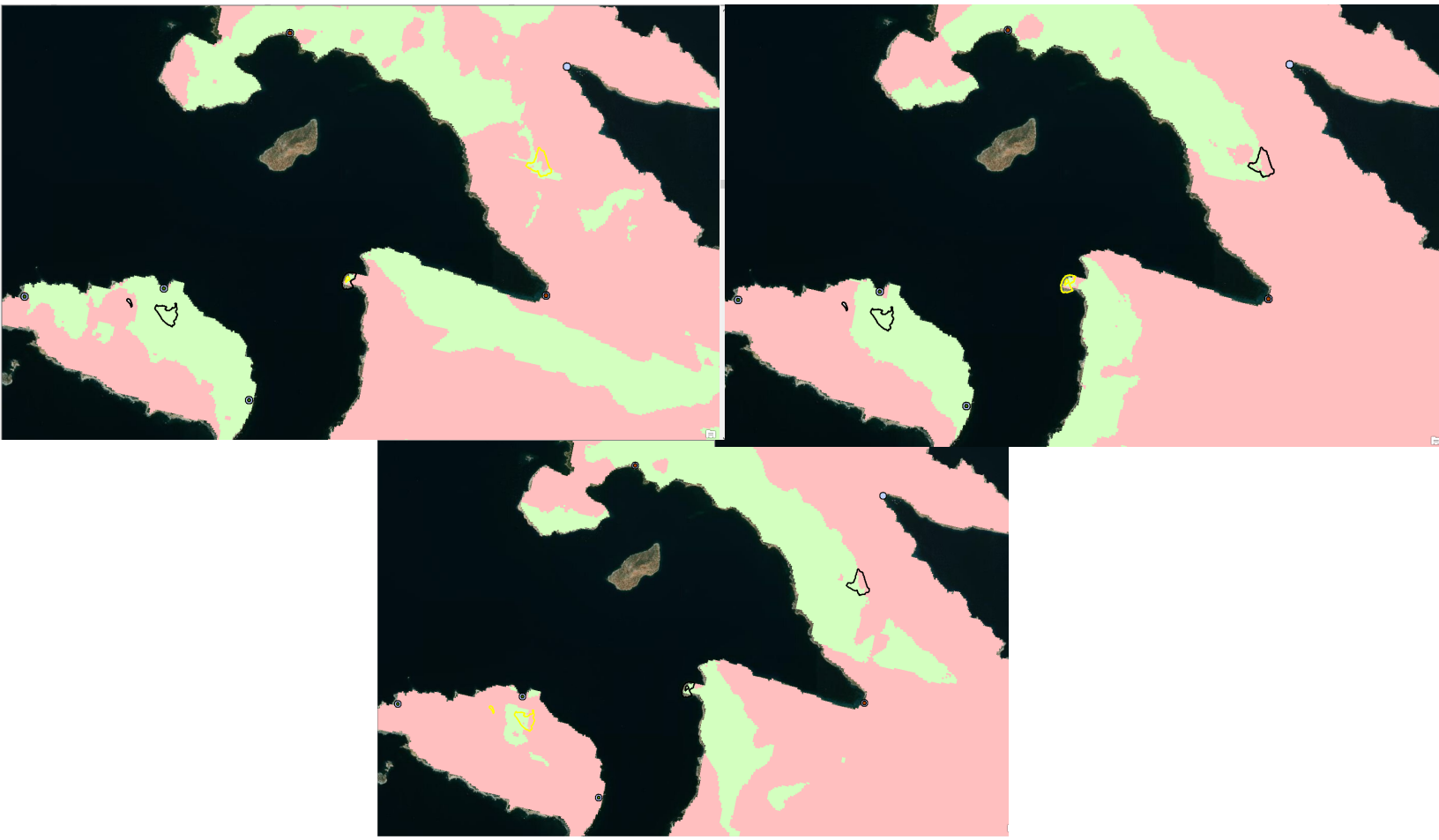
In general, all the Roman fortifications are technically capable of providing concave fire against an attacking force at some point during the route the enemy would have to take to assault the fortress, with a few caveats. As stated, Kastelli's defenders would almost always have the ability to fire on the enemy's right flank; however, concave fire would only be achieved in any significant sense once the enemy were inside the outer walls, at which point the left-flank firing position, the outer rampart and towers, would be quite easily overrun and negated through accessing the walls by whatever means the defenders used. The smaller emphasis on this tactic in Kastelli is likely explained by its being a double-layered fortification, meaning that the defense of its outer gate was not the only option, as defenders had a fortified keep as a fallback, which none of the other kastra appear to have had. The second caveat regards Chora Kastro, which is that, when considering its Roman predecessor, it must always be noted that its structure would likely have varied, though the degree is impossible to ascertain, beyond the obvious addition of cannon embrasures. The profusion of walls and foundations within Chora Kastro may well conceal or repurpose or overlie a Roman inner wall which once protected a keep like that of Kastelli; without an intensive survey to answer this question, it will remain unanswered.

Intervisibility

The pre-Roman fortresses of Kastellas and Kastri lack intervisibility, as does almost every major center of activity at the time. The island appears to lack a mutually-dependent fortification system, instead having two small fortress/settlement systems, one consisting of Kastri above Emborio, and the other of Kastellas above Embolas. The settlement-town system

does not seem to apply to Damos, leaving it as somewhat of an oddity with its lack of nearby fortifications. However, for the first two examples, it seems that intervisibility was only important between each settlement and its associated fortification, as there are no attempts by such fortifications to "bridge the gap" between the three regions of the island, and thus each would have been effectively isolated when threatened.

During the seventh century, under the Romans, the move toward fortified habitation areas seems to have also promoted a more unified island-wide approach to building defenses. The abandonment of Embolas in favor of Rina at the mouth of the bay was likely motivated by economic factors, since the harbor would always have been vitally important, and the hidden nature of the valley would protect it adequately on its own. Beyond Rina, the three fortifications of Kastelli, Galatiani, and Agios Konstantinos are all mutually intervisible from at least one point within the site, and, combined, can see the entire occupied west of Kalymnos north of Vigla hill, as well as out to much of the northern waters, past Telendos to the south, and basically all the approaches to their portion of the island (figs. 17, 18, 19). While rough terrain would make actually moving large numbers of troops or civilians between these locations difficult, the value of being forewarned could be significant, allowing these settlements to 'turtle up,' becoming sufficiently unattractive targets as to deter raiders. Time would be of the essence, and the forewarning these positions could provide may have meant the difference between a raid suffered and a raid averted.



Figs. 17, 18, & 19. Galatiani (Fig. 17, top left), Kasteli (Fig. 18, top right), and Agios Konstantinos' (Fig. 19, bottom) viewsheds showing intervisibility between the three fortifications. Map of Kalymnos, Greece from: "Kalymnos, Greece" Map, *Google Earth.*

Chora Kastro's significant visual separation from the other three kastra is likely explained by their abandonment in the 10th century, and the rise of Chora Kastro soon after in the late 11th century (Koutellas, "Ta Kastra," 437, 441). The numerous ruins of rural churches and monasteries indicate that settlements were likely still dispersed, but the establishment of Chora Kastro represents a fundamental shift in the population dynamics of the island, indicating a population high enough that it would best benefit from protecting itself first and foremost. Moreover, it speaks to the shift in population distribution as well, considering that there were

clearly enough people living in the relatively open and (compared to Vathy) less fertile southern valley to warrant the construction of such a large town, a clear indication that there were few significant threats during this brief period. The highly defensible position of Chora Kastro is not necessarily superior to that of the earlier three kastra, and its lack of intervisibility with any contemporary Roman fortress indicates that the inhabitants probably relied almost entirely on isolated watch posts. What Chora Kastro has, that the earlier three kastra do not, are an abundance of living space, accessibility, and economic potential all in one. The entire southern valley is easily accessible from the Kastro, which is much more agriculturally productive than the steep surroundings of the other three, allows it to benefit from ports at either end of the valley, and obviates the need for any further fortification in the valley due to its central location, making it a remarkably efficient use of labor to build. The near-abandonment of the southern valley did not repeat as it did during late antiquity, and the population continued to utilize the valley despite threats which might have urged them to seek more remote locations. Clearly the Roman builders of Chora Kastro had found an ideal site, since the oft-shifting population of Kalymnos continued to inhabit the fortified town through the reigns of three empires, and the only recorded instance of its walls being breached was the result of an earthquake in 1493, and were quickly repaired (Koutellas, "Ta Kastra," 441). This is all the more impressive when one considers that it was the target of many raids, including several that nearly depopulated the island, and yet the surviving elements of the fortifications show no signs of battle damage despite those incidents (Heslop 39).

Research Questions

The fortification scheme of Roman Kalymnos went through three distinct phases throughout time. The first phase seems to have been very peaceful, with Hellenistic fortifications

being abandoned, and even city walls being left in ruins after their destruction by the A.D. 554 earthquake. The second phase of the fortification scheme breaks sharply from the first, responding to the threat of Arab raids by concentrating the population (other than Rina) in three intervisible kastra, using expediently constructed but excellently sited and laid-out fortification walls to protect the inaccessible settlements. The third and final phase of fortification on Kalymnos was centered around Chora Kastro in the southern valley, providing a much larger population center than any that had existed during the previous phase. The centrality of Chora Kastro would be maintained for centuries, well after Kalymnos left Roman rule.

The construction of the kastra was almost certainly prompted by the seventh-century Arab raids. The circumstances surrounding their construction, aside from the raids, were the collapse of the eastern portion of the Empire, the establishment of the theme system, the defeat of the imperial military on land, and more importantly at sea, and the disruption of the economy by the Arab conquests. While no evidence confirms or disproves that Kalymnos was directly raided, the great volume of raids, combined with their significant presence in Roman writings suggest a high probability that this was the case.

The process of building the kastra would have varied significantly based on a number of difficult-to-detect factors. However, it can be confidently stated that the seventh-century kastra were not funded by either the imperial court or some high officer of the Karabisianoi, but likely were built using resources available on the island and funded locally. Lacking any other obvious source, and considering the kastra were all settlements, it is likely that the labor for their construction was provided by their inhabitants, but that their specific layout and siting were influenced by an individual or group with experience in military matters.

Strategically, the seventh-century kastra ensured that Kalymnos could remain an open port for trade and resupply, and that the navies of the Karabisianoi and later Kibyrrhaiotai did not need to hawkishly patrol the surrounding waters to keep the island relatively safe. Tactically, the seventh-century kastra all possess excellent fields of fire against any attacking force, regularly exploit the enemy's right flank and possess concave firing positions, allow for effective placement of artillery, create clear sight lines for signaling and detection of threats at great distances, and generally are sited so as to make any raid tremendously costly.

Kalymnos' place in the Empire is reflected in the dispersal of its kastra. Each of the seventh-century fortifications is close to the sea but difficult to access, despite much more accessible coastline nearby. The dispersed population and seaside proximity is a clear indicator that the island was a hinterland reliant on trade and exploitation of maritime resources, but not so successful in either of these things to warrant enough protection to obviate the need for fortified settlements. Moreover, the rubble walls of its kastra indicate the local nature of the defensive effort, and thus the relative unimportance of the island in the grand scheme of imperial defense.

The value of GIS is its ability to systematically apply criteria and quantify data rather than make general assessments. Mapping would have been key without GIS, but with it, conclusions can be drawn with far greater precision and confidence. Weapon ranges could not be drawn without the use of GIS, nor could cost-paths or viewsheds be established. The intervisibility of the sites would have been impossible to determine based on available photography and textual evidence due to the rarity of visitors to Galatiani, and the use of modern boats to access both Agios Konstantinos and Kastelli would have left little information about how the sites would have originally been approached.

Chapter 7: Conclusion

Any examination of the literature on these sites would be incomplete without acknowledging the unfortunate combination of their being understudied and over-visited. Further research must be conducted to draw solid conclusions about the kastra, but with tourism comes the degradation of these sites, year by year. As the archaeological potential of the kastra erodes, so too does their value to modern populations. Further protections for the kastra of Kalymnos should be prioritized before valuable information on an elusive period is lost forever.

Beyond the obvious need for in-person observation, future studies of the kastra, either through excavation or non-invasive methods, would be of tremendous value in clarifying the nature of the sites. Such studies would allow for a precise chronology to be established, activities of the inhabitants to be understood, and perhaps even allow interpretations as to the degree of militarization of the inhabitants.

Much GIS work remains to be done on the kastra of Kalymnos. The use of a proper military toolset capable of accurately simulating ballistic trajectories would allow more nuanced understandings of the fields of fire of the kastra, and permit new conclusions to be drawn about how they would have been defended and attacked. Moreover, with greater research into sources of water on the island, significant conclusions might be drawn about the positioning of kastra relative to locations of ancient wells, with significant implications on the options available to contemporary raiders. In general, deeper investigation into the raiders' side of the conflict would be of great value. Nonetheless, this study provides a strong baseline in spatial analysis of the island, upon which future research can build.

The following can be determined with a reasonable degree of confidence about the kastra of Agios Konstantinos, Galatiani, and Kastelli:

The three kastra were built in the seventh century in response to the growing threat of Arab naval attack, likely while Kalymnos was under the control of the Karabisianoi. These sites were permanent settlements of considerable size for the island, were built by local laborers with local materials, and likely had some form of military expertise involved involved in their planning. The kastra were likely built to meet local needs, rather than fulfill a request from on high. Their designs all stress concave firing positions, terrain exploitation, and intervisibility.

Agios Konstantinos' fortifications were likely built of local natural rubble, with possibly a small amount of Hellenistic spolia in its western wall. Though the evidence for the kastra as settlements is rather clear, Agios Konstantinos is certainly one, based on its sheer size and number of houses. The number of house remains, large cisterns, and substantial church suggest a significant resident population. From the military standpoint, Agios Konstantinos features the most complete concave field of fire of any of the kastra at its northern gate, where attackers would be funneled up a narrow streambed, with defenders in elevated positions to their sides and front, and eventually even to the rear. The wall stands above one of only two reasonable landing spots on the north side of Telendos, and grants defenders the ability to fire down to the beach, or even further with artillery. Even more than the other two, Agios Konstantinos is remarkably efficient in terms of the strength of its defenses relative to the labor they would have required to build.

Kastelli was the most heavily fortified of the three kastra, the only one with two layers of walls, and the only one to still preserve crenellations. Its thick walls cut off the peninsula on which it stands, which is surrounded by steep rocky slopes, and protected at the rear by a lower wall circuit. Its well-preserved cisterns are remarkably large for a site so small in total area, suggesting a great ability to withstand siege. While not quite as expansive as those provided by

Galatiani, Kastelli acts as the centerpoint of the intervisibility network of the three kastra, and allows views of the entire Telendos straits. It possesses numerous firing positions and the only indisputable remains of towers. Combined with its position close to the coastal cliff face, this would allow artillerists within Kastelli to shut off all passage along the land corridor of the west coast, as well as threaten vessels at sea out to a considerable distance. While this kastro has finer stonework than the other two, no existing explanation for this is logically consistent, and it may merely be a result of the less naturally defensible terrain of the site, compared to the other two. Kastelli's fortifications would have likely been the most labor intensive to build by far, and their organization suggests an effort to make the most defensible site possible given the terrain, meaning that the site itself was likely too good to pass up for any number of reasons.

Galatiani contrasts with the other two kastra due to its location and its preservation. The highest in elevation, Galatiani is further inland and higher in elevation than its contemporaries, and significantly less preserved, despite being so out-of-the-way. The location of Galatiani would certainly have complicated trade and travel, but the security of its natural setting was significant, and the views it offered were unparalleled, allowing it to clearly see past Telendos and out all the way to Asia Minor's shores. Thus, military reasons were likely even more significant as a factor in the selection of Galatiani's location than for the other kastra, where such reasoning was already clearly at the top of the list. This concern with defense is shown also in its extensive fortification, taking the form of a mere single layer of walls, but a single layer that wraps all the way around the nearly-sheer western slope, as if to make extra sure that none would even attempt the climb. By contrast to Agios Konstantinos, which, in many places, allows cliffs to serve as its barriers, Galatiani's design seems excessive. It likewise features flank exploitation at its north and south gates, with both featuring projections that would allow for fire from both flanks.

Indeed, like Agios Konstantinos' east promontory, Galatiani's north promontory would allow defenders to pour fire into enemies for hundreds of meters before they could even make the final approach to the gate. Galatiani's cisterns are huge, but the number of houses recorded in schematics is relatively small, especially considering its massive internal area. It is unclear if more houses are simply unidentified or buried, but, if not, Galatiani would have a dramatically lower population density than the other two kastra.

Unfortunately, all of the previous conclusions become very hazy when applied to Chora Kastro, separated as it is by time and topography, and, more importantly, its lack of remaining identifiably Roman components. The only firm conclusion that can be drawn is that, when considering its foundation on the heels of the abandonment of the seventh-century kastra, the establishment of Chora Kastro indicates another dramatic population shift, on the scale of that which preceded the original three.

Kalymnos was, by all indications, beneath imperial attention, and secondary at best in the Empire's military plans for the eastern Aegean. The island is absent from major texts, lacks inscriptions from the period, and its contemporary houses were largely built of rubble. Yet, in the face of economic collapse and enemy attack, the people of Kalymnos, a mere handful of generations after an earthquake that sank their best port beneath the sea, fortified themselves in three highly secure kastra or took refuge in the valley of Vathy. These activities indicate a level of energy and innovation not often associated with peripheral areas, and the expertise evident in the careful selection of sites and planning of defenses suggests a familiarity with defensive tactics as and the conventions of fortifications in the empire. Wherever this knowledge came from, the pragmatic application of these principles to their specific geographic location allowed

the island to remain a functioning portion of the Empire throughout the entire period of Arab raids.

Though the east fell rapidly to the Arabs, the Empire had clearly done right by the Kalymnians in some way, as demonstrated by the remains of the kastra they built that are still visible today. Through multiple lines of research, including analysis of textual sources, personal observation, archaeological data, and GIS analysis, the function and nature of these fortifications can be elucidated. As these sites continue to decay, archaeological intervention would be vital in preserving this important record of a people caught between the rubble of antiquity and the fires of the middle ages.

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